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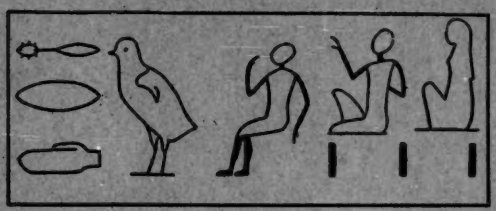
CHILD DEVELOPMENT



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UNPLEASANT DREAMS IN CHILDHOOD

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Earlier studies of dreams have been concerned chiefly with the subject-matter of such dreams as happen to be remembered for some time, and with the possible significance or interpretation of these dreams. The present investigation was undertaken to determine the frequency of unpleasant dreams in children during a set period of time. Our interest was primarily in the proportion of children who report or give evidence of having unpleasant dreams; and secondarily with the factors that may condition such dreams.

The data were obtained from seven-day records kept by Minnesota parents on their children under twelve years of age. Every morning during the period, the answers to a set of questions about possible unpleasant dreams experienced by the child during the preceding night were recorded. Obviously, such a technique insures a higher validity of report than do estimates of the frequency of unpleasant dreams. By this technique, the probable changes with memory in the reports of dreams which occurred in the more remote past are minimized and the number of reports and the time of year at which the reports are made are controlled.

For each night of a week in the late fall of 1935, the parent answered the following questions:

1. Did you hear the child cry or moan during the night?
2. Did the child come to an adult during the night, showing fear?
3. Did child, when asked in the morning, remember having a bad dream?
4. If child had a bad dream, about how long did he cry or stay awake?
5. Do you know what he was afraid of? If so, what?
6. Has he had same or similar dreams before?
7. Can you think of any recent happening which might have caused the dream?

All of these questions, with the exception of the fourth, yielded data for analysis. Many reports on the fourth question, were so vague that no attempt to summarize the answers has been made.

In addition to the data recorded daily, the parents also reported the name, age and sex of the child, the ages of his brothers and sisters, whether or not the child slept in a bed alone, who if anyone shared his bed, who if anyone shared his bed-room, whether or not an adult could hear the child if he cried or whimpered in the night, what severe illness the child had had during the past six months and a judgment as to his present state of health.

In Table 1 the subjects are distributed by age and by place of residence. They come in much greater proportion from the large cities than from the rural areas when compared with the distribution of place of residence of children in Minnesota given in the 1930 census. In 1930 the proportion of 5-9 year old children living in the cities was one third, in towns, one fifth, in rural areas just under one half. Over two-thirds of our children come from cities, one eighth from towns and one sixth from rural areas.

TABLE 1

Distribution of Subjects by Age and Place of Residence

Ages	Number of Cases	Percentage living in		
		Cities	Towns	Rural Areas*
1-4	81	46.9	23.5	29.6
5-8	215	73.5	7.9	18.6
9-12	223	77.6	12.6	9.9
All Cases	519	71.1	12.3	16.6
1930 census	(ages 5-9)	33.5	20.2	46.3

* Cities: population 50,000 and over; Towns, 2000-49,999; Rural areas, less than 2000.

* From Institute of Child Welfare, University of Minnesota

Our group is, then, composed very largely of city children.

Table 2 shows the distribution of our cases by the socio-economic status of the family as determined by paternal occupation.

TABLE 2

Distribution of cases by Minnesota Occupational Scale

Socio-Economic Status	Percentage		
	Our cases	WHC sample	U.S. population 1930 census
I. Professional	30.6	2.7	2.6
II. Semi-Professional and Managerial	14.8	5.2	7.2
III. Clerical, Skilled Trades, Retail Business	32.0	15.7	13.8
IV. Farmers	5.6	18.0	15.4
V. Semi-Skilled Occupations, Minor Clerical Positions Minor business	14.8	29.2	23.8
VI. Slightly skilled Occupations Requiring Little Skill or Ability	1.4	12.3	14.5
VII. Unskilled Laborers	.7	16.9	22.7

The second column shows the comparable distribution for the sample obtained for the White House Conference Studies[1], with which some of our data is later compared. The last column presents the distribution for the United States population according to the 1930 census. Our group has come overwhelmingly from the upper socio-economic strata. Although the proportion listed from the farming group is very small, actually the number should be higher. Some of our records were obtained through the cooperation of rural study groups. In some instances in these records, the occupation question was unanswered.

The educational level, in terms of the mean number of years spent in school, of the fathers in our group was 14.2 years with a standard deviation of 4.2 years, as compared with 9.9 years with a standard deviation of 4.8 years for the White House Conference group. For our mothers, the mean educational level was 13.2 years with a sigma of 3.0 years as compared with 10.2 years with a sigma of 3.8 years for the White House Conference group. This shows that both the mothers and fathers of our group are well above the average cultural level.

There are two possible measures of frequency of unpleasant dreams: the number of children giving evidence of any unpleasant dreams during the week of recording; and the mean number of unpleasant dreams reported per child. Since the occasional child who has an unpleasant dream every night in the week will have a very great influence on the means of a rather small group, probably the presence or absence of any dreams is the more adequate measure.

TABLE 3

Percentage Children Having Some Unpleasant Dreams During Week

Age	Boys		Girls			Both Sexes Percentage
	No. of Cases	Percentage	No. of Cases	Percentage	D σ_d	
1-4	40	42.5	39	43.6	.109	43.0
5-8	114	41.2	103	36.9	.644	39.2
9-12	110	21.8	111	22.5	.123	22.2
All ages		33.3		31.6		32.5

[1] Anderson, John E. (chairman). The Young Child in the Home; a Study of Three Thousand Families. D. Appleton-Century Co., 1936.

Table 3 shows the percentage of the two sexes in the different age-groups who gave any evidence of unpleasant dreams during the week. It will be remembered that in the questionnaire there are three possible indicators of unpleasant dreams: crying or moaning in the night; coming to the adult with show of fear during the night; reporting an unpleasant dream in the morning. In Table 3 positive evidence on any one of these three questions on any night in the week would place the child in the group having an unpleasant dream during the week. Practically no sex differences appear. Age differences, however, are evident since there is, with increasing age, a reduction in the proportion of children experiencing unpleasant dreams.

Table 4 based on the mean number of unpleasant dreams per week shows that the frequency of unpleasant dreams per child also decreases as the children grow older. When the various indicators of unpleasant dreams are considered, considerable variation between the age-groups is found. As children grow older, they moan less often in their sleep and come to the adult less often because they are afraid. But reports of unpleasant dreams increase from the first age-group to the second, possibly because of a better memory of dreams, and a more accurate report. Thereafter they also decrease. In fact the mean number of unpleasant dreams reported for ages 9 to 12 is almost as small as for the very youngest group.

TABLE 4

Evidence of Unpleasant Dreams (Means per week per child)

	Ages Both Sexes			All Ages	
	1-4	5-8	9-12	Boys	Girls
Moans during night	.81	.57	.17	.48	.38
Comes to adult	.18	.16	.05	.12	.11
Reports bad dream in morning	.21	.42	.26	.31	.21
Any evidence of bad dreaming	.93	.71	.39	.67	.54

TABLE 5

Effect of Number of Siblings on Frequency of Unpleasant Dreams

Children in family	Size of Family		Unpleasant Dreams	
	Our groups	WHC%	Mean No. per week	% Showing some unpleasant dreams
1	15.6	23.0	.58	31.6
2	38.8	27.1	.62	35.3
3	26.0	18.9	.59	32.4
4	10.8	10.6	.51	24.6
5	4.6	7.7	.37	31.6
6	2.3	5.0	.36	36.4
7+	1.9	7.7	1.50	40.0
Mean size of family	2.7	3.1		

In Table 5 the distribution of unpleasant dreams in families of different sizes is given. The first columns show that the children in this study come from families which are somewhat though not materially smaller than those studied in the White House Conference. The two remaining columns show that there is no relation between the number of children in the family and either the mean number of unpleasant dreams per week or percentage of children showing unpleasant dreams. The number of siblings then seems to have no effect upon the presence or absence of unpleasant dreams.

Table 6 distributes our data according to the conditions under which the child sleeps. Three fourths of the children for whom records were kept sleep in a bed alone, and a third have a room to themselves. Sleeping conditions seem to effect the frequency of unpleasant dreams. Both the smallest proportion of the children having unpleasant dreams and the smallest number of unpleasant dreams per week are found in those children who sleep in a bed alone and in a room alone.

TABLE 6

Effect of Sleeping Conditions on Frequency of Unpleasant Dreams

	Sleeping conditions %	Unpleasant dreams	
		Mean No. per week	% showing some unpleasant dreams
In a bed alone	78.0	.57	32.1
With another child	5.1	.70	36.7
With an adult	16.9	1.00	45.5
In a room alone	36.8	.48	28.0
With another child	41.7	.56	29.0
With an adult	17.9	.90	39.2
With adult and child	3.5	1.13	52.2

The presence of another child in the room does not increase the number of unpleasant dreams to any great extent. The greatest proportion and highest frequencies occur where children sleep in a room with an adult and another child. Although it is possible that the larger number of dreams reported for children sleeping in a room with adults may be due to the fact that the adults can hear children in the room while they do not hear children sleeping in another room, practically every parent reported that the children's moaning or crying in the night could be heard. When a child sleeps in the same bed with another child both the frequency of unpleasant dreams and the proportion of children having them is increased. This increase is even more marked when children sleep with adults.

TABLE 7

Effect of State of Health upon Frequency of Unpleasant Dreams

Health said to be:	No. Cases	Percentage of cases	Unpleasant dreams	
			Mean No. per week	% showing some unpleasant dreams
Very Poor	0	.0		
Rather poor	1	.2		100.0
Fair	32	6.2	.94	34.3
Good	251	48.9	.62	36.0
Excellent	229	44.6	.48	31.7
Ill during last six months	56	10.9	.91	40.0
Not ill during last six months	459	89.1	.53	32.8

That the state of health of the child is related to the likelihood of unpleasant dreams is found in Table 7 which shows that the better the child's health the fewer unpleasant dreams are reported and (roughly) the larger the number of children showing no bad dreams at all. Table 7 shows also the data obtained in answer to the question as to whether or not the child had had a serious illness within the last six months. Ninety-two percent of the children had not been ill. The mean number of unpleasant dreams in those who had been ill is much higher than in those who had not been ill; moreover, the number of children showing no evidence of unpleasant dreams during the week is higher among those who had not been ill. The reports suggest that certain illnesses (such as nose and throat difficulties) may be greater offenders than others in the matter of causing unpleasant dreams. Unfortunately no information on the exact date of the illness nor any measure of its severity is available. A further study might reveal a relationship between type of illness and frequency of unpleasant dreams during the succeeding months.

TABLE 8

Subject-Matter of Bad Dreams (Percentages)

age	1-4	5-8	9-12	Boys	Girls
Personal difficulties	26.7	33.3	54.5	36.7	37.3
Difficulties of friends or pets	13.3	6.3	18.2	10.2	9.8
Animals (probably strange,or fearful)	40.0	15.9	9.1	18.4	17.6
Strange or bad people	6.7	20.6	13.6	9.8	24.5
The unknown,dark,etc.	6.7	7.9	.0	8.2	3.9
Loss of property	.0	4.6	.0	4.1	2.0
Impersonal danger	6.7	9.5	.0	10.2	3.9
Miscellaneous	.0	1.6	4.5	2.0	2.0

In Table 8 an attempt has been made to classify the subject matter of the dreams by both sex and age. In their unpleasant dreams, the youngest children dream most often about animals; the middle group about strange or bad people and about the impersonal types of danger such as war, fire and electricity; the oldest children about difficulties surrounding themselves, their friends or their pets. Girls are much more apt to dream about strange and bad people than are their brothers; while boys show a much greater tendency to have dreams concerned with types of impersonal danger. It is possible that girls are more often warned to avoid strange men, and that boys have had more experience and therefore understand more clearly the dangers of fire and electricity.

In studying the reports of the parents as to the content of the dreams and the reports as to earlier events which might have caused the dream we have come to the following conclusions:

The content of the dream comes most often from experiences of the preceding day, particularly when these experiences are exciting or emotionally toned. Sometimes, but rarely, the content comes from earlier vividly unpleasant experiences.

Although the dream is occasionally an approximate repetition of an experience of the previous day, usually one character or event is taken from the day's experience and appears in the dream in a different setting or with an altered character. A dog who was friendly when seen in the afternoon may become an angry dog in the dream.

Certain states seem to predispose the child to unpleasant dreams. Among these, the most common are: over-excitement, fatigue, illness, indigestion and any unpleasant emotional state such as fears, worries or anger and quarreling.

Many of the mothers wrote in detail of their experience with unpleasant dreams either with the child upon whom report was being made or with older children in the family. Many of the reports on older children carried the note "Used to have bad dreams a few years ago." It was impossible to decide from these reports just when the peak of bad dreams had come for these children, but it was certainly before the age of 9 or 10. In table 9 a summerization of the mother's statements about the causes of dreams is made.

A variety of factors affect the dream process. These include the content of the experiences immediately preceding sleep and the outstanding events of the day, which may be carried over into the dream with a similar or a different emotional tone than that originally characteristic of them. In addition the physiological state of the child, as reflected in his state of health, recency of illness, fatigue, the character of his food, etc., affects the dream process. A third set of factors is related directly to the sleeping conditions, i.e. whether the child sleeps in a bed with another or in a room with another. Almost no recurrent dreams of the type which have been emphasized so much in the literature were reported. This may indicate that in young children, dreams, like waking mental

states, have relatively less organization than in older persons.

In children's dreams, it is quite possible that the boundary between latent content and manifest content is tenuous, and may in many instances not exist and that the disguise, distortion, condensation, etc., often so marked in the dreams of adults, may be of little or no significance. It must be remembered that because the dream is largely visual in character some transformation of content will take place. Anyone who has made attempts to represent verbal or emotional experiences pictorially, will realize the limitations imposed by representation of content in a visual form.

TABLE 9

Mother's statement of causes of bad dreams

	Number Reporting
Over-excitement or fear	137
Physical conditon of child	71
Noise during night	2
In particular out of 210 reasons given, we have: the following distribution:	
Frightening stories read or heard	31
Extreme emotional state of child	25
Illness	22
Fatigue	21
Radio programs	19
The day's experiences	19
Movies	18
Food or time food eaten	18
Conflicts with playmates	11
Physical condition at night	10
Too strenuous play	10
Funny papers	4
Noises at night	2

Freud assumes that basically all dreams are related to sex. The results obtained in this study offer little or no support for such a position. With persons in late adolescence and early adult life and with neurotic individuals with unresolved sex conflicts, it is possible that sex may be the most frequent determiner of the dream state. But the dreams of infants and young children seem to be closely related to their daily experiences and are affected by illness, the emotional events, excitement, vigorous play, etc., which occur just prior to sleep. The factors which affect the dream process change with age and with the shifting pattern of motivation and the organization of the psyche.

It seems to us that our results are most readily explained in terms of the analysis of the psyche made by Lewin[2] in the article on the Dynamic Theory of the Feebleminded, in which he describes the psyche as possessing what are in effect three dimensions of which the first is concerned with the stratification of the psyche or its division into tension systems. The second involves the readiness of communication between these systems due to the firmness of their boundaries, and the third is the psychical content. As development proceeds stratification increases and the separation of systems increases. Content is a matter of the historical experience of the individual. Similar principles operate with reference to the genesis and differentiation of tension systems in the face of widely varying content.

In children the dream may be regarded as a tension system which originates either on the basis of an experience or an internal need and which takes from the psychic content a form which may or may not have a connection with underlying tension system. In our results there are dreams, set off by emotional excitement just before bed time or by a fearsome experience during the day, in which the dream content parallels the experience of the day. In other dreams originating on the same basis the emotional tone is opposite to that of the experience of the day.

The most interesting portion of the results is found in the tendency for un-

[2] Kurt Lewin. A Dynamic Theory of the Personality. New York: McGraw Hill, pp. 194-238.

pleasant dreams to decrease with age. If sleep is viewed as the satisfaction of a need and development as a process of moving from a dynamically stronger gestalt to a weaker gestalt, this result becomes comprehensible. With development the boundary between sleeping and waking becomes more firm and the dynamic unity of the psyche weakens. On this basis tensions originating during the day would be expected to carry over into sleep less frequently as the individual grows older. In other words there is a sharper separation between the sleeping and waking state in the more mature person. Supporting evidence for this position is to be found in the observation frequently made that infants do not seem to be quite themselves for some time after awakening, whereas adults seem to be ready to function almost instantly upon awakening.

If sleep itself is viewed as the result of a tension system originating in a physiological need that moves toward satiation, or equilibrium, and Lewin's principle that the psyche as a whole may reach an equilibrium with a sub-system out of equilibrium, then it becomes clear that in sleep there is an inclusive tension system arising out of a need which overpowers the organism and which moves toward satiation irrespective of the tension in sub-systems. Presumably there may come a time when the primary need of the organism for sleep is partially met, i.e. the system as a whole has reached partial satiation. By that time the tension in the sub-system may become relatively so great that it will take command of the psyche.

Presumably the dynamic unity of the organism in sleep is greater than it is in the waking state. Sleep itself possesses some of the characteristics of a stronger gestalt. Hence, interruption or disturbance of sleep is an unusual rather than a characteristic phenomena.

SUMMARY

1. The study is based upon 519 one-week records of unpleasant dreams in children of 12 years of age or less, who come from families living in cities and families which rate above the average in education and in socio-economic position.

2. No reliable sex-differences appear.

3. The number of unpleasant dreams per child and the proportion of children having such dreams decreases with age.

4. The size of family appears to have no influence upon the frequency of unpleasant dreams.

5. Children sleeping in a bed alone show fewer unpleasant dreams than do those sharing a bed with another child and many fewer than children sharing a bed with an adult.

6. Children sleeping in a room alone show fewer unpleasant dreams than those sharing a room with another child. More unpleasant dreams are found when the child shares a room with an adult and still more when he shares the room with an adult and another child.

7. The better the general state of the child's health, the less frequent are unpleasant dreams.

8. Children between the ages of one and four have unpleasant dreams most often about animals, between ages five and nine about strange or bad people and about such impersonal dangers as war, fire and electricity; between nine and twelve about difficulties surrounding themselves, their friends and their pets.

SUMMARY - Concluded

9. The content of the dream is usually derived from exciting or emotionally toned experiences of the preceding day.

10. Children apparently are predisposed to unpleasant dreams by such states as: over-excitement, fatigue, illness, indigestion, fears, worries, anger and quarreling.

VARIATIONS IN EMOTIONAL RESPONSES OF CHILDREN

BUFORD JOHNSON[1]

Observation of the everyday behavior of children in a Nursery School group suggests wide variability among children in emotional responses. Fortunate environment in conditioning of fears does not seem satisfactory as an explanation of the wide differences in the behavior of the child for ages eighteen months to five years of age in adjustment to new and varied situations. The child's perception of the situation may make it interesting or fear-provoking. Fear may change quickly into anger and the aggressive responses may be influential in elimination of fear.

Motivation of the child toward the end result or the goal to be reached is desirable for reduction of attention to the seemingly difficult situation presented to him. The difficulty then arises of the individual differences in ease of motivation. The question must be faced: What are the variations among children in these responses we term resistance or fear? Granting the efficacy of associative or conditioning methods in overcoming of fears, study of the child's perception of the situation or motive in response is important.

In this study the factor in the situation that was novel or difficult, that provoked discomfort or fear, was inherent in the response pattern. The three situations presented were planned for a progressive increase in motivation to succeed in a difficult situation. In the first series completion of a given task was the goal. In the second the desired object could be seen but could not be obtained except by responses involving the unpleasant factor. In the third situation the desired objects were a means of producing discomfort. In Series I and III a slight electric shock was the unpleasant factor. In Series II a loud sound was the only unpleasant factor in the experimental set-up though the child's previous experience in Series I introduced other factors. The sound had occurred in Series I without consideration of it as a disturbing factor. It was employed as an aid in recording responses. Our preconceived notions as to effect upon some children of such a sound were certainly erroneous. We had assumed that they would be interested in making the bell ring but we learned that it was highly disturbing to some children.

The ages of the children ranged from 29 to 69 months. Some children were in their third year at the Child Institute of the Johns Hopkins University. With four exceptions all had been attendants for the academic year. They were always eager to come to this experimental room for games and also knew the camera man.

SERIES I

A tracing board illustrated in the photographs offered the task of tracing with a stylus in a pathway. The bottom and sides of the path were of separate plates of brass. The stylus and tracing board were connected with high voltage terminals with sufficient resistance in series to give a shock of 3 tenths of a milliampere when the stylus touched the sides of the pathway. A bell of the ordinary type used for doorbells was wired in the series in such way that when the contact of stylus with side of pathway was made the bell sounded. The strokes of the bell were counted as a record of number of contacts made or of electric shocks received. The pathway was one half an inch wide and about one fourth of an inch deep. Previous study of the child's ability in tracing this pathway assured us that it would not be done without contacts. The child was shown how to hold the stylus and as the experimenter demonstrated, was told:

Begin here and go down this path until you reach this end. Do not touch the sides but stay in the path. Now you go down the path.

The stylus was then given to the child. No contacts were made in the demonstration and the sound of the bell was a new feature to the child. In later

[1] From The Johns Hopkins University.

trials with children who were disturbed by the bell the demonstrator touched the sides with the hope of alleviating fear of the sound.

It must be understood that we were not concerned with the child's ability to trace the path without contact but with his persistance in the difficult situation. The records as given for Series I show that some children were little affected by the bell or the shock and completed the task. Others were so upset by the sound of the bell that they would not continue. Some showed interest in making the bell ring and required much persuasion to move along the path. Some children put the stylus down immediately when a contact was made or the shock was received. Others were persuaded to continue.

SERIES I

TRACING BOARD WITH BELL AND SHOCK

Subjects	Age in months	Sex	Touches or shocks in Trials			Remarks
			1	2	3	
B. D.	64	Girl	7	6	12	
M. K.	69	Boy	5	5	5	
S. C.	62	Boy	5	6	8	
T. J.	62	Girl	9	10	5	Said "like to make bells ring"
S. F.	51	Boy	9	12	13	
B. F.	51	Boy	12	9	7	
J. P.	37	Girl	Did not keep in path. Enjoyed making bell ring.			
M. M.	35	Girl	Enjoyed first ringing. Started tracing path. Dropped stylus saying "It hurt", cried softly. Would not try again.			
S. A.	35	Girl	Slow to take stylus. After hearing bell touched several times then held against side with continuous shock and ringing. Dropped stylus. Refused to try again.			
T. M.	43	Girl	Slow to begin. Continued with slight urging. Kept bell ringing continuously but completed path. Would not try again. Said, "I not like that bell."			
H. K.	36	Boy	Would not try. Bell was sounded for him. Backed away, pupils enlarged. Longer ring was made. With trembling voice said he wanted to go back to his room.			
Z. J.	47	Boy	Backed away at sound of bell, pupils enlarged. Would not touch stylus but asked to have bell ring. Winced each time. Would not try.			
H. L.	47	Girl	After bell rang would not try. Tried to leave room. Was urged to try but refused.			
W. G.	46	Girl	Had fingers in mouth. They were dried but probably damp. Dropped stylus, immediately on contact. Would not try again.			
M. B.	36	Boy	Backed away at sound of bell, said "Turn off." Wanted B. J. to ring. On continued ringing repeated "Turn off", clinging to B.J. Was told he could go. Went to porch then returned asking B.J. to ring who made a quick ring. Took stylus but on contact dropped quickly, saying "My thumb, it hurt." Would not try again.			

SERIES I

TEST REPEATED ONE WEEK LATER

Subjects	Age in Months	Sex	Remarks
H. L.	47	Girl	Refused to stay in room, dashing out. Was urged to stay and see others do it. When two of her group came in who liked it, she said "I want to sit down." Took chair other side of room. Before one began tracing left room saying "I do not like that bell."
W. G.	46	Girl	Did not want to come in room. Was finally lured near table holding to hand of B. J. when asked to take stylus threw arms around B.J.begging to go.
M. B.		Boy	Wanted to hear bell but would not try. Liked repeated short rings but when prolonged wanted to leave room.
S. F.		Boy	Trial 1 - 8 touches; 2 - 9 touches; Occasionally sighed.
S. C.		Boy	Trial 1 - 7 touches; 2 - 7 touches. Played with making bell ring at different places. Wanted to know why some places would not make a ring.
M. K.		Boy	Trial 1 - 6 touches; Trial 2 - went back to beginning when he touched; tried not to touch. Completed with 5 touches.

One would require a picture of the total behavior pattern to understand the variability among the children in this situation. The photographic illustrations taken from moving pictures on second trials give some evidence of it. The strangeness of the tickle in the fingers from the shock often caused a look of consternation, pupils enlarged, and a general survey of all about them. Some said "It's funny" or "It hurts." Even in such cases they often looked toward the screen which concealed the shock apparatus and bell as though wondering if it came from there. Again they would move the stylus around in the air, suggesting wonder that the funny feeling had gone. Some put the stylus down immediately a shock was received and only with difficulty were persuaded to try again. The extreme exception was one who would not come into the room again.

We recognize that there are individual differences in susceptibility to electric shock though we state the amount of the shock given. Some gave no evidence of noting a tickle or prickling in the fingers. Some children remarked "It's funny" but made no objection to it. The loud sound was more objectionable to some than the shock. In a few cases it appeared that one contact gave a much stronger shock than previous ones. The child would suddenly drop the stylus and say "It hurt!" After such remarks some completed the task. Children tend to grasp the stylus low and with the whole hand and also change the grasping method during the performance.

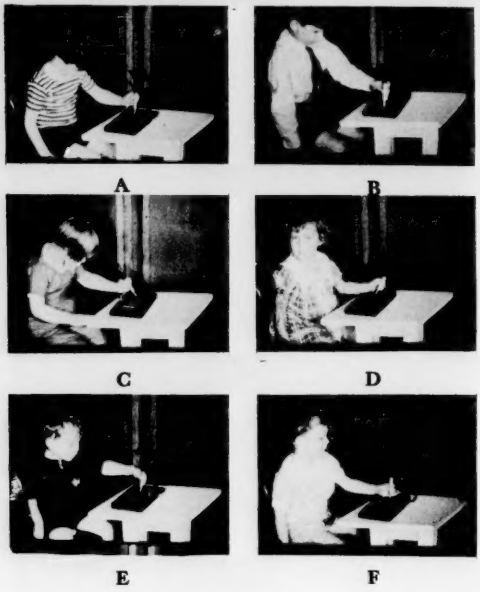

Figure 1.
Photographic illustrations for six children in Series I, showing five who were attentive to the task. Subject D liked the bell but disliked the shock and refused to complete test. A and B-Subject M. K. C - Subject T. M. D - Subject M. M. E - Subject Y. B. F - Subject H. D.

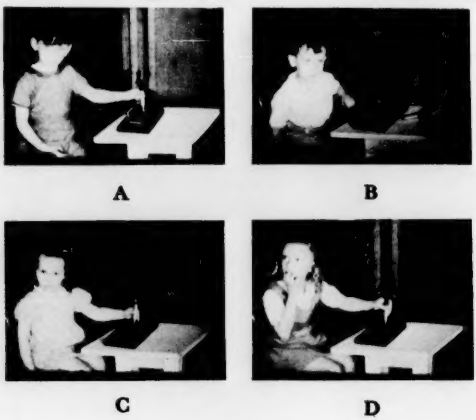

Figure 2.
Photographic illustrations for second trial of four children who refused to complete Series I. A - Subject Z. J. B - Subject H. K. C - Subject S. A. D - Subject K. N.

There were seven, four boys and three girls, who completed the task without giving evidence of emotion other than interest. Three children were excited by the shock and did not continue. One of these objected first to the bell. Five others were upset by the sound, some showing marked emotion and failing to continue.

A week later the test was repeated for three who were most disturbed without success in reducing the fear. Three who were not emotional on the first test again completed the task and two of these engaged in experimentation with the performance.

SERIES II

Since both bell and shock elicited responses that we may term fear reactions in some children in Series I, the bell alone was employed in Series II. An investigation of the child's method in solution of a problem was undertaken by Elisabeth Mast with these same children. It was arranged to have the same bell as employed in Series I wired in series with the stylus used to open the box and the spring on the box. A glass covered box contained a colored rubber toy which the child could obtain by making the lid fly open. The only method of opening was to push the point of the stylus through a small hole far enough to release a spring. The box is illustrated in Figure 3. As the opening was surrounded with brass it was possible to have the bell sound continuously after contact of stylus in the hole until the spring was released.

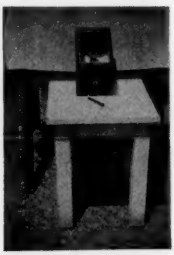

Figure 3

The records for Series II show that ten of 22 children manifested no fear nor dislike for the bell. Among these was the youngest subject, a girl 29 months old, and five children under 38 months of age. Five children showing dislike or startle at sound of bell continued trying to open the box. Some did not solve the problem on the first trial but were willing to return until they were successful. This required as many as five periods for some and in a few cases startle or verbal responses indicated continued dislike of the bell. After success there was often an eagerness to try again for a toy.

SERIES II

OPENING THE BOX WITH BELL RINGING

Subjects	Age in months	Sex	Trials	Remarks
W. E.	29	Girl	1	Jumped when bell rang but kept stylus in with continued ringing until box opened.
			2	Succeeded in two seconds. Then demonstrated how to do it.
T. B.	35	Boy	1	Rang bell frequently, said "I want the doll." Succeeded.
			2	Put stylus in hole immediately, succeeded in 35 seconds.
Y. B.	35	Boy	1	Rang bell continuously until box opened.
			2	Put stylus in hole immediately, succeeded in 21 seconds.

SERIES II - Continued

OPENING THE BOX WITH BELL RINGING

Subjects	Age in months	Sex	Trials	Remarks
J. P.	37	Girl	1	Rang bell immediately, said "It's just like Miss Johnson's."
			2	Said "I won't ring the bell will I?" Pushed stylus in, talking all the while.
			3	"I'm going to open the box today." "Put it in the little hole, I guess but the bell rings if I try it." Laughed.
M. M.	35	Girl	1	When bell sounded said "I can't, I don't want the noise." B.J. held her hand as bell rang, then told her to try, said, I can't. Finally opened the box.
			2	Said "I want you to do it for me." Was urged to show how to do it and succeeded in 4 seconds.
S. A.	35	Girl	1	Startled at first ringing,then wanted to continue ringing.
			2	Said "May I ring?" Jumped each time bell rang, talked throughout trial.
			3	"When I make noise, it comes open." Rang bell several times. Refused to continue. Said she would do it another day. Failed to get toy on each trial.
H. D.	35	Boy	1	After opening box demonstrated how to do it.
			2	Took a long time, no objection to bell.
L. M.	36	Girl	1	Kept bell ringing continuously without indications of dislike for it.
			2	Put stylus in hole immediately. Opened box immediately.
S. F.	51	Boy	1	Kept stylus in hole, ringing continuously until success.
			2	Succeeded in two minutes, 25 seconds.
Z. J.	45	Boy	1	Put stylus in hole. Said "I don't want to, I don't like that noise." Refused to continue.
			2	Said "I'm going to get the truck this time." Opened box in 6 seconds.
			3	Succeeded in 2 seconds.
L. H.	47	Boy	1	Said "I don't know how, you do it." Put stylus down and said "I can't." Took sytlus again but would not touch box.

SERIES II - Continued

Subjects	Age in months	Sex	Trials	Remarks
L. H. (concluded)	47	Boy	2	Startled by bell. Rang bell off and on for five minutes. Seemed embarrassed. Said "It's a hard job for me to get the box opened."
			3	Put stylus in hole, causing sound, but withdrew immediately. Tried again with bell ringing but would not push through.
			4	Jumped when bell rang, tried again until successful.
			5	Succeeded in 4 seconds.
M. B.	36	Boy	1	Rang bell. Did not like it, said "It hurt." Refused to try again. Said "Tomorrow." Was brought to room later same day, shown how to open box and permitted to have a toy as he was leaving school that day. Went away very happy.
T. M.	43	Girl	1	Said "I don't like that noise," but put stylus in hole.
			2	Asked questions about bells, and lights, but put stylus in and was successful in less than 2 minutes.
			3	Succeeded in 3 minutes. No objection to bell.
H. K.	36	Boy	1	When bell rang, said "I think I will have to go out now." Continued but when stylus was held on plate and bell rang, did not move it towards hole.
			2	Touched plate, asked "Has Miss Johnson gone home? That big noise scares me to death." Kept trying but would not push stylus through after ringing. Did not want to leave without toy and was told he could come back another day.
			3	Put stylus on plate immediately. Continued until he succeeded. Was elated over getting toy.
K. J.	30	Boy	1	Touched plate immediately ringing bell. Dropped stylus, picked up and rang again, said "It hurts my ears; I want to get doll." Tried again.
			2	Rang bell continuously for more than 3 minutes until box opened.
			3	Succeeded in 9 seconds.
B. D.	64	Girl	1	Startled when bell rang, would not touch plate again.
			2	Asked to have box opened for her. Finally tried, said "Oh!" as bell rang but pushed and succeeded.
			3	After 1 minute 30 seconds, tried. Startled at bell. Jumped each time bell rang. Did not succeed because stylus was withdrawn when bell rang.

SERIES II - Concluded

OPENING THE BOX WITH BELL RINGING

Subjects	Age in months	Sex	Trials	Remarks
B. D. (concluded)	64	Girl	4	Started to put stylus but hesitated. Jumped at bell. Wanted to try again. On success said "I got it."
W. G.	46	Girl	1	When bell rang, said "No more." After refusal to try was shown where to put stylus. Then pushed it in and opened the box.
			2	Said "It hurts me." Trembled but tried with success. Then demonstrated, saying "You put it in here."
H. L.	47	Girl	1	Did not want to come in room. Finally persuaded to sit down before box. Rang bell after 4 seconds, then ran out of the room. Said later she wanted toy in box.
			2	Went to room but quickly withdrew. Would not enter. Said she would do it tomorrow.
			3	Tried to get her in room again but failed.
K. N.	68	Girl	1	Would not take stylus in hand. Finally permitted to go.
			2	Startled by bell. When urged to try again asked "Is it going to ring?" Would not touch plate again.
			3	Did not want to try. B.J. held her hand on stylus and pushed into opening. Did not like bell but continued pushing after hand was released.
			4	Put stylus in hole, kept trying until success. Said "It's funny, isn't it?"
S. C.	62	Boy	1	Succeeded in 2 seconds, no objections to bell.
T. J.	62	Girl	1	Running questions as to how to open box. Required five minutes.
			2	Succeeded in four seconds.
M. K.	69	Boy	1	Succeeded in 2 seconds.

Seven children manifested much more emotion. Success in the case of W.G. was attained after evident emotion was shown when bell first rang. This was probably due in great part to association of bell with shock in Series I when she was greatly disturbed. The record of H.L. who was the only one who refused to try at each period is similar to that for Series I. She appeared to be distressed by the sound. The variations in emotional behavior are not explained by age or sex differences.

SERIES III

Interest in obtaining the toy in Series II had minimized the effects of the sound and in Series III only the electric shock was introduced as an annoying situation. The same tracing board and shock apparatus as employed in Series I

was presented. Instead of tracing the path the child was asked to push balls into a basket with the stylus. A steel ball bearing was placed in the path four sections from the end and the child was told that if he pushed it into a basket he could have it. A wastepaper basket on the floor would catch a ball when it was pushed off the end of the board. When the stylus touched the ball a shock was received. The shocks were more continuous in this series and the task more difficult as the ball was pushed about the turns. If the ball was early pushed off the board in such way that it rolled onto the floor the child could not have the ball. After the first success a child was given an opportunity to get a second ball. Only two balls were permitted to a child. If he did not want to try for a second ball he was not urged to do so. The results for Series III show the large number obtaining two balls.

SERIES III

STEEL BALL BEARINGS AS GOAL. ONLY TWO BALLS PERMITTED TO A CHILD.

Subject	Age in months	Sex	Balls obtained	Remarks
W. E.	29	Girl	2	
T. B.	35	Boy	2	
Y. B.	35	Boy	2	Stopped 3 times on receiving shock. Started to push with hand. Again took stylus and obtained ball.
J. P.	37	Girl	2	
M. M.	35	Girl	1	Refused to try again.
S. A.	35	Girl	1	Refused to try again.
H. D.	35	Boy	2	
B. J.	36	Girl	1	Refused to try for second ball.
L. M.	36	Girl	2	
S. F.	51	Boy	2	Cautious at first, slow but persisted.
Z. J.	45	Boy	2	
L. H.	47	Boy	2	
T. J.	62	Girl	2	Lifted stylus from ball as though amazed. Continued with light touches.
M. K.	69	Boy	2	
K. N.	68	Girl	2	
B. D.	64	Girl	2	
H. L.	47	Girl	2	When first asked to go down refused. Said, "Do not want your game." After several had returned to the class room was asked again. On refusal was told she need not play game but must go down. Cried but was taken down and allowed to sit at a distance and observe. Finally walked near board to watch but refused to try and went back to room. Later asked to come down and watch another child, but again declined to try saying she would do it tomorrow. An hour later was sent a message that she could come down and get the balls if she wished as there would be no balls for her tomorrow. Came down stairs alone, approached board cautiously, slowly lifted stylus and pushed ball. Greatly pleased to obtain one. Repeated performance obtaining second ball and went away laughing aloud and calling "I got two balls."

Children who were wary and appeared somewhat distressed on completion of Series I were much quicker in response to Series III. In several cases the stylus was dropped after contact with the ball and in other cases attempts were made to change it to the other hand. All children tested in Series III went through the test and left the room very happy. All except three obtained two balls. One child H. L. required unusual tactics as described in her record for Series III and one other, W. G. was not even urged to come down to the experimental room. The reason in the latter case was that she was so upset in Series I it was difficult to get her into Series II. With final success in that she was seemingly over her fear responses to the room and to the experimenters. On the last day of school we did not consider it wise to risk another upset. In no case did we end the study with the child unhappy over the experiences.

The results for the three series show that there are marked variations among children in responses to situations that may be termed annoying or fear-provoking. This variability is not directly related to age or sex for this group. Both tracing the path and opening the box might be assumed to be more difficult for the younger children hence prolonging the unpleasant situation. The tendencies manifested by the children who appeared most fearful are similar to the everyday behavior of these children in situations that offer difficulty or uncertainty as to what to do. Some tend to attack such situations with caution or timidity but slowly enter into it and work toward success. Others tend to withdraw, solicit others to do for them, and watch on the side lines. Of the group of six who were most apprehensive in Series I and II and timid or withdrawing in initial attack upon Series III, some are assertive in social contacts with those whom they know or in familiar situations. Only close observation over a period of time would show their tendencies to approach a new or difficult situation with a fearful attitude.

The motivating factor in the child's response to a situation presented to him for the first time is often difficult to recognize. Distracting the child's attention from the novelty or difficulty and the slow process of associating a pleasing object or act with the unpleasing or feared object does not seem the most promising method of motivation. The child's perception of the situation and the end toward which he directs his activities are most important for understanding his behavior and for aiding him to overcome difficultities in individual and social adjustments. In the most difficult situation, Series I, with no reward other than success in completing a suggested task some were eager to succeed. Attention was given to the performance; sound or shock were seemingly neglected. The reward, if the steel ball bearings are so considered, was apparently effective in reducing attention to the shock. This reward was not something to be attained at the completion of the task but formed an essential part of the response activity. The activity of pushing the ball, of obtaining it for himself appeared highly motivating. For those who obtained only one ball the response was too unpleasant or not sufficiently interesting to make the ball a potent reward.

We cannot ignore the tendencies of the child to seek the pleasant or to avoid the unpleasant yet we often wonder why a child finds some acts pleasant and others unpleasant. It does appear that in situations in which a child directs his own activities toward a recognized goal, attention and resistance to the difficult or unpleasant elements are decreased. If the goal is a major part of the response pattern success is attained by a larger number than when the goal is an unrelated reward for completion of the task.

AN ANALYTICAL STUDY OF CHILD LEARNING

VIRGINIA L. NELSON[1]

In the field of learning, experiments with young children offer most promising opportunities. It is a question whether the so-called rational learning test differs greatly in the principles involved from other types variously called motor skill or formation of associations or solution of problems.

In 1918, Peterson (4) published results from a group of learning experiments about which he says, "A sort of choice-reaction problem is presented to the human subject, about whose rational ability there is no doubt. It is our purpose to see how rational learning is related to learning that must depend wholly on 'trial and error' efforts. How effectively are ideas used in a type of learning in which their employment is obviously helpful?" The experiments in question and results of later investigators who have used Peterson's test will be discussed here as being similar to the learning problems in the present investigation. None of the subjects so far have been young children, the studies have been made with college students, with disabled soldiers, and in comparative studies of negroes and whites. In the Rational Learning Test, as devised by Peterson (4) in 1917, the numbers one to eight inclusive were assigned in random order to the first eight letters of the alphabet. The reactions required of the subject were to associate each of these numbers with the letter assigned to it. This was to be done, according to the author, by means of a series of guesses, the range of which might be greatly limited by the use of a rational organization of the situation. Each subject completed the learning at a single sitting, the learning being completed when the subject had given the whole series twice without error. Record was kept of time, repetitions, and errors. There are three classes of errors: unclassified errors, all responses made except the correct ones; logical errors, numbers which have already been used for earlier letters of the series; and perseverative errors, numbers already guessed wrongly for the letter in question. The test is of such nature as to admit of several forms of different grades of difficulty according to the numbers of letters used.

Various forms of the Rational Learning Tests have been used extensively by Peterson and his students, particularly in a series of studies of the comparative abilities of negroes and whites (5) (6) (7) (8). It is interesting to note that they found the negroes to be relatively stronger in retention than in rational organization when compared with the whites.

Heron (3) conducted a study in which he used five stylus mazes of slightly different patterns and two forms of the Rational Learning Test, a ten-letter and a fifteen-letter form. Results indicated that there was practically no relationship between the learning of the maze and rational learning. Also, there was found a fairly high degree of relationship between the scores in the two Rational Learning Tests.

Haught (2) in an investigation of the interrelation of some learning processes with eighty college students used two forms of the Rational Learning Test, the ten-letter form and one which he called "Rational Learning (Modified)." Apparatus similar to that used in the last named test has been employed in the present investigation of the learning of young children and will be described in detail later. It consisted of a board through which were put bolts arranged in rows. One bolt in each row was connected in an electric circuit so that a bell would ring when the correct bolt was touched by a stylus which was also a part of the electric circuit. Records like those originally devised by Peterson were kept. Correlations and inter-correlations were calculated and it was found that for the Rational Learning Test repetitions and perseverative errors were the significant factors, that is, contained everything that was common to the other factors. For Rational Learning (Modified) time and unclassified errors were the significant factors. Garrison (5) later under somewhat different conditions, with the eight-letter form of the test, found time and logical errors to be the most important and reliable factors, when correlated with intelligence. Both Haught and Garrison found positive correlations between intelligence and the different test factors

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with the exception of perseverative errors, which were not found to be statistically reliable by Garrison.

PROBLEM

The need of further study and analysis of the learning of young children under experimental conditions has prompted this investigation wherein was presented to the child a learning problem, the completion of which depended more on the use of ideas than on the development of a comparatively high degree of motor skill.

The investigation consisted of three experiments in each one of which different groups of children were subjects. In some instances, however, a child who had not completed one experiment was used in a later one.

Subjects.

The subjects in this study were sixty-seven children enrolled in the Child Institute of the Johns Hopkins University with a chronological age range of 2 years 4 months to 5 years 4 months and an Intelligence Quotient range of 96 to 168. The chronological ages were reckoned at the beginning of each learning problem. The Intelligence Quotients were derived from the Stanford Revision of the Binet-Simon tests, which were available for all subjects. These intelligence tests were given as a part of the Child Institute routine and, with five exceptions, had all been given within four months of the time each learning experiment began.

Apparatus and Procedure.

Apparatus which has been built in the Psychology Laboratory of the Johns Hopkins University according to Haught's (2) description of his Rational Learning board was used in all three experiments in this investigation. This description is given below:

> "The apparatus consists of a board about twenty inches square through which are put one hundred bolts arranged in ten rows with ten bolts in a row. The rows are lettered from A to J and the bolts in each row are numbered 1 to 10. One bolt, and only one, in each row is connected in a circuit with an electric bell so that when the bolt is touched with a stylus the bell will ring."

In the diagram of the apparatus that follows each O represents a bolt. The letters A to J and the numbers 1 to 10 were pasted underneath the sides of the board and were not visible to the child during the experiment.

J	O	O	O	O	O	O	O	O	O	O
I	O	O	O	O	O	O	O	O	O	O
H	O	O	O	O	O	O	O	O	O	O
G	O	O	O	O	O	O	O	O	O	O
F	O	O	O	O	O	O	O	O	O	O
E	O	O	O	O	O	O	O	O	O	O
D	O	O	O	O	O	O	O	O	O	O
C	O	O	O	O	O	O	O	O	O	O
B	O	O	O	O	O	O	O	O	O	O
A	O	O	O	O	O	O	O	O	O	O
	1	2	3	4	5	6	7	8	9	10

The above description applies to the Learning board used in all three experiments. The whole board was used in the preliminary experiment and on the basis of the results obtained it was decided to use only a part of the board for the

later experiments. The board was too large for the children to reach with ease and also required a longer period for a trial than children of this age will usually attend or cooperate. One-fourth of the board was used for the later series. Thus the learning in experiments II and III was concerned with five rows of bolts, five in a row, one bolt in each row so connected in a circuit with an electric bell that when the bolt was touched with a stylus the bell would ring. The original board was covered with black cloth, with the exception of the lower left quarter of the board. The learning board was firmly attached to a table whose top was slightly tilted in order to make it comfortable for the child to reach all of the bolts easily and to give him the best possible view of the whole top of the board. The stylus with which the bolts were touched was six inches long and was of light weight, the metal core being covered with a handle of hard rubber and the part grasped by the child one-half inch in diameter. This proved to be satisfactory for all subjects with the possible exception of the two-year olds. Fatigue expressed by two of them may have been partly due to this source.

The experiments were all conducted with only the subject and the experimenter present in the room. The procedure in general was the same for all experiments. The child came into the room to play a "game," which soon became known as the "ring the bell game." The child always stood in front of the board with Row A nearest him. The experimenter was seated behind him and slightly to the right. In this way the experimenter had a full view of the subject's performance and could record all responses as made. The child always began a trial with the stylus held in his right hand. Time was kept with a stop watch. Record of each bolt touched by the subject was kept. In the preliminary experiment Peterson's (4) method was followed, the experimenter writing down the number of the particular bolt touched. In Experiments II and III mimeographed record sheets like the diagram of apparatus were used. The experimenter drew a continuous penciled line on the record sheet, which indicated each bolt touched by the subject and the order in which it was touched. Figure 1 gives a replica of the record of the first and last trials of one of the subjects who completed Experiment II and one who completed Experiment III.

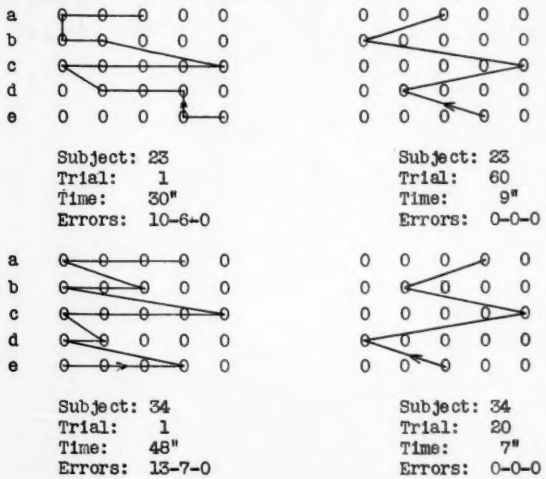

Figure 1.

Replicas of records of the first and last trials of subject 23-II and of subject 34-III

EXPERIMENT I

In the preliminary experiment in this investigation the Haught Rational Learning board was employed. The board was arranged for schedule 1: A-6, B-4, C-9, D-1, E-8, F-10, G-3, H-2, I-7, J-5 as described by Peterson (4). This means that when bolt 6 in row A, bolt 4 in row B, etc. were touched with the stylus the bell would ring. When a non-ringing bolt was touched, that is, all bolts except those enumerated above, it constituted an error. In this investigation Peterson's (4) classification of errors was considered as follows: 1. unclassified errors, those errors which consisted in touching any bell that did not ring; 2. logical errors, errors which consisted in touching a bolt that had already been used for an earlier letter in the series; 3. perseverative errors, errors which consisted in repeating a wrong response.

Eight children, 4 years of age, took part in the preliminary experiment. It was decided to use the same instructions in this form of learning as was used with adults. On the basis of the results modification of procedure in later forms was made. The child came into the room with the experimenter to play a "game" and was shown the board covered with a cloth. As the child stood in front of the board the experimenter removed the cloth and said "You see this board. It has ten rows of bolts, ten bolts in each row. One bolt in each row and only one will ring a bell when you touch it with this stylus. (The experimenter showed the stylus which she held in her hand and continued). In each row a different bolt rings. The game is to begin with the bottom row and find the bolt that rings the bell. As soon as the bell rings go up to the next row and find the bolt that rings. Keep on up to the top row and find all the bolts that ring. Remember (pause) begin at the bottom row and as soon as the bell rings find the next bell. The game is to find all the bolts that ring just as quickly as you can." The experimenter laid the stylus down on the board and as the child picked it up said, "Begin with the bottom row. Now, go ahead."

When the trial was completed the experimenter said, "Let's play the game again. Remember, begin with the bottom row and find all the bells. As soon as the bell rings go up to the next row." Three trials were given in one sitting.

A sitting of four repetitions was tried out with the first subject taken, a boy who was most cooperative. He required 455 seconds to complete the sitting, the time of the repetitions being 105, 112, 98 and 140 seconds respectively. This was too long a sitting for children of the ages under consideration so it was decided to have each sitting consist of three repetitions. A total of 121 repetitions was secured from the eight subjects before the close of the school session which terminated this preliminary experiment.

In table 1 the total number of repetitions, total time and total errors for each subject are given. As this was undertaken as a preliminary experiment, the subjects were given opportunity to continue the problem until the close of the school term. Absences account for the irregular number of repetitions for each subject.

A study of the results obtained from this exploratory experiment revealed certain trends which seemed suggestive despite the extreme difficulty of the board and the small number of children concerned. A decrease in average time and errors was noted when the averages of the earlier trials were compared with the averages of the later trials. (See figures 2 and 3). Certain bolts were learned more quickly as to their position on the board. The first and last bolts in a row, D-1 and F-10, were found without error the greatest number of times. (See figure 4). The ringing bolts in the bottom and top rows, A-6 and J-5, came next in the order of times found. The tendency of some of these children to begin each row at the extreme right or the extreme left of the board may somewhat explain the greater number of successes for D-1 and F-10. Three of the children began with the first bolt in a row more than 50% of the time and two began with the last

bolt in a row over 50% of the time. Individual differences were marked for amount of time required per trial and for the number of perseverative responses. For total number of errors and for logical errors the individual variations were small. There were wide variations from day to day for individual children.

TABLE 1

Scores for individual subjects in rational learning.
CA chronological age in years and months at beginning of experiment; IQ Stanford-Binet Intelligence Quotient; UC unclassified errors; (L) logical errors; (P) perseverative errors; DNC "did not complete."

Subject	CA	IQ	Sittings	Trials	Time	Errors			
						UC	L	P	
1	3-11	104	3	10	1391	496	256	54	DNC
2	3-11	108	1	3	453	146	76	16	DNC
3	4-4	115	5	15	1451	673	329	10	DNC
4	4-5	128	5	15	2011	730	359	29	DNC
5	5-0	129	7	21	2347	963	528	21	DNC
6	5-3	101	8	24	2757	966	521	31	DNC
7	5-3	133	8	24	4331	1113	518	138	DNC
8	5-4	137	3	9	807	387	194	6	DNC
Total			40	121	15548	5474	2781	325	
Average per trial					128.45	45.45	22.9	2.7	

EXPERIMENT II

The inadequacy of the entire Haught Board for the study of learning of children as young as this group led to use of only a portion of the original board in the second and third series. One-fourth of the Haught Board gave a pattern of five ringing bolts from a total of twenty-five instead of a pattern of ten ringing bolts from a total of one hundred. This proved to be a difficult enough pattern for children of these ages.

Twenty-four children between three years and five years, four months old took part in the experiment. The method used was a three minute work limit with an interval of one week between sittings. All children were allowed to complete the trial in process when the three minute working time was up but no new trial was begun within five seconds of the end of the three minutes. Two somewhat different methods of attack were used in this work limit experiment, which will be described as Form A and Form B. The schedule of ringing bolts for both Forms A and B was the same as illustrated in figure 4. No ringing bolt was directly over or under the ringing one in the adjoining row nor was it adjacent to the ringing one.

The board was mounted as in the preliminary experiment. The child and the experimenter were also in the same relative positions. The child stood in front of the board with the experimenter seated behind him and slightly to the right with stop watch and stenciled record blank out of the range of vision of the child.

At the first sitting the following directions were given to each of the eighteen children in Form A. "You see this board. Here are some rows of bolts the same number in a row. (The experimenter ran her hand along the five rows). One bolt in each row rings a bell when you touch it with this stylus. (Here the experimenter showed the stylus which she held and touched the ringing bolt in the third row). Only one bolt in each row will ring. The game is to begin with the bottom row and find the bolt that rings the bell. As soon as the bell rings, go up

to the next row and find the bolt that rings. Keep on up to the top row finding the bolt in each row that rings. I want you to learn so that you will touch only the bolt that rings. Begin with the bottom row here. (Pointing toward bottom of board.) Now, go ahead."

If the child hesitated too long at any time he was urged to go on. When one trial was completed the experimenter said: "Now, let's play the game again. Ready, go."

At the second sitting one week later the directions to the child were shortened. When he was standing in front of the board and the cover had been removed the experimenter put the stylus in the child's hand holding it as she said, "You know what you did before, you began with the botton row and touched the bolt in each row that rings. Remember you want to learn so you will touch only the bolt that rings. Ready, Go." As before if the child hesitated too long or stopped he was told to, "Go on and find the bell." When one trial was completed he was again told, "Now let's play the game again. Ready, Go," until three minutes' time was up.

Form B. In the course of the experiment it seemed to be of interest to know how children might attack a problem of this kind when left more to their own devices. A few children were tried in learning Form B which was similar to Form A except that the children were allowed to begin to touch the bolts on any row. They were told that,"only some of the bolts ring" instead of being told that only one in each row would ring.

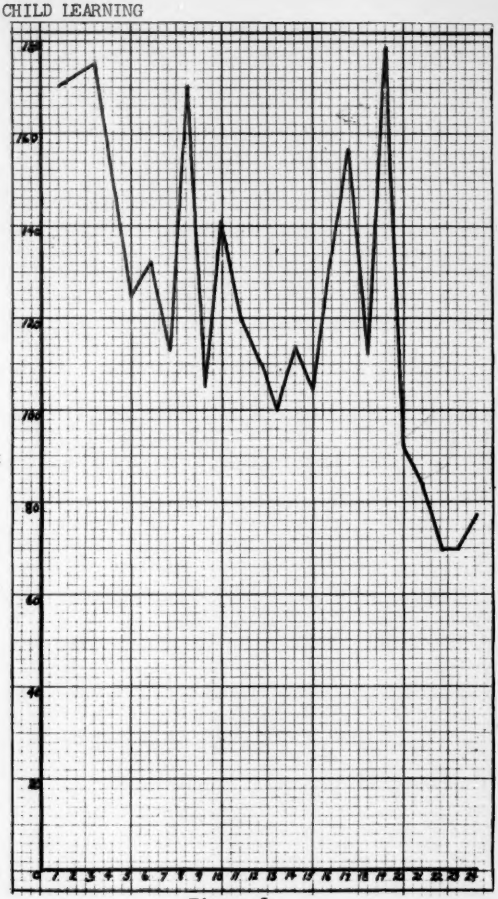

Figure 2

Mean time required by the group for each trial

Table 2 gives the total scores for trials, time in seconds, and classified errors for each child. The general intelligence of the children as shown by the Stanford Revision of the Binet-Simon Scale was distinctly above normal with the exception of a few cases. A total of 591 separate repetitions was made by the 18 children. The average time for the group for the 591 repetitions was 26.5 seconds, the average number of errors was 8.7.

Table 3 gives the distribution of errors for each subject for Forms A and B arranged according to the row in which they occurred. The fewest number of unclassified errors occurred in Row d where the first bolt was the ringing one while the greatest number of unclassified errors occurred in Row c where the fifth or last bolt was the ringing one. This bolt was the one demonstrated by the experimenter. The rows ranked according to the smaller number of unclassified errors were d with 1143 errors, a with 1243 errors, e with 1289 errors, b with 1481 errors and c with 1768 errors.

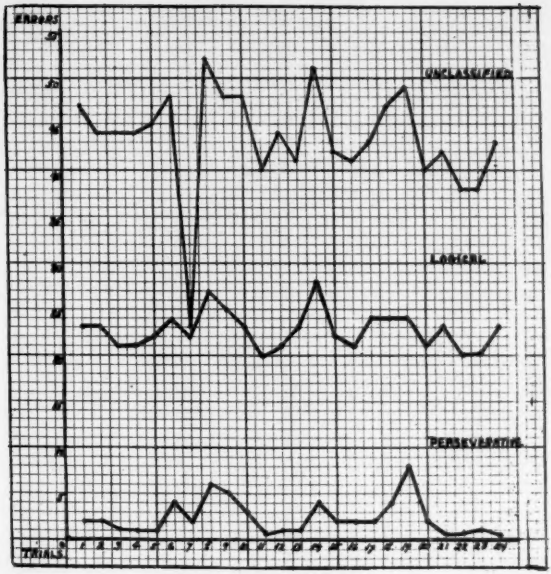

Figure 3
Mean score for errors made by group on each trial

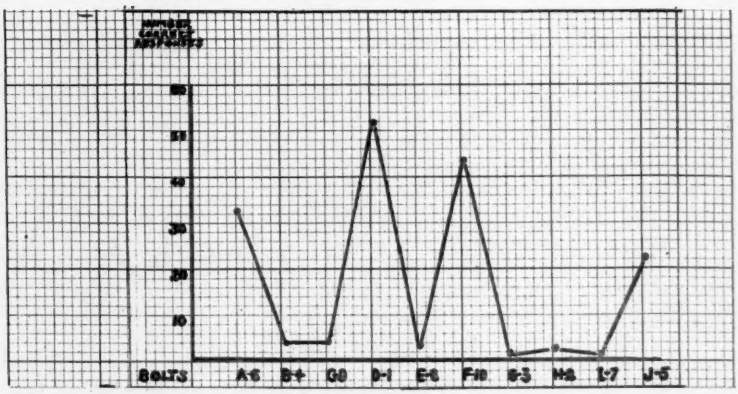

Figure 4
The total number of correct responses by all eight subjects in Experiment I, for the ringing bolt in the respective rows.

TABLE 2

Distribution of repetitions, time in seconds and classified errors in Learning II A and B. CA chronological age in years and months; IQ intelligence Quotient; UC unclassified errors; (L) logical errors; (P) perseverative errors; DNC did not complete.

II FORM A

Subject	CA	IQ	Sittings	Trials	Time	Errors			
						UC	L	P	
1	3-0	127	3	9	555	112	68	6	DNC
2	3-2	121	5	14	884	227	109	11	DNC
3	3-5	116	6	28	1086	313	138	25	DNC
4	3-5	130	3	13	540	200	109	9	DNC
5	3-6	135	4	25	724	209	102	14	DNC
6	3-6	120	7	53	1264	514	269	36	DNC
7	3-8	141	6	34	1100	344	205	0	DNC
8	3-11	116	6	49	1081	328	126	7	DNC
9	4-0	149	6	53	1122	275	156	13	
10	4-2	113	3	9	558	106	53	11	DNC
11	4-6	132	6	60	1080	325	136	7	
12	4-8	135	3	21	518	145	67	1	
13	4-9	133	4	27	632	260	108	6	
14	4-10	115	2	3	366	40	21	5	DNC
15	4-11	133	3	24	547	187	76	8	DNC
16	4-10	104	5	56	844	411	239	8	
17	4-11	104	9	50	1334	441	252	7	DNC
18	5-2	115	8	63	1440	697	276	45	DNC
Total			89	591	15676	5134	2508	219	
Average					26.5	8.7	3.5	.4	

FORM B

19	3-7	116	4	7	719	148	73	59	DNC
20	3-10	105	5	25	896	643	349	178	DNC
21	4-4	117	2	2	360	63	30	29	DNC
22	4-4	132	5	15	836	93	47	31	
23	4-11	115	2	9	363	132	57	32	DNC
24	5-4	111	5	41	906	711	330	83	DNC
Total			23	99	4080	1790	886	412	
Average					41.2	18.1	7.9	4.2	

The number of times the ringing bolts were found without errors is given in table 4. d-1 again has the first rank with a score of 372. The other bolts in order of time found are respectively c-5, a-4, e-3 and b-2. The number of errors within a single row is determined in part by the order of striking the bolts. Since the children varied widely in methods of finding the ringing bolt these individual differences explain in great part the frequency of errors for particular rows of bolts. It is clear for this group that the first and last bolts in a row are found without error, that is, they are learned more quickly than other bolts.

TABLE 3

Distribution of classified errors for each subject for each row in Learning II, Forms A and B

Subject	Trials	ROWS a			b			c			d			e		
		UC	L	P	UC	L	P	UC	L	P	UC	L	P	UC	L	P
1	9	10	0	1	21	8	1	32	20	2	31	22	1	18	18	1
2	14	43	0	0	54	13	5	44	22	4	45	33	1	41	41	1
3	28	73	0	1	50	10	6	114	57	17	19	14	0	57	57	1
4	13	37	0	0	38	11	1	29	16	2	56	42	4	40	40	2
5	25	25	0	0	57	18	7	80	42	6	19	14	0	28	28	1
6	53	76	0	7	72	12	4	203	105	16	56	43	6	107	107	3
7	7	22	0	6	30	3	11	37	19	15	25	19	12	34	34	15
8	34	35	0	0	104	34	0	1	1	0	136	102	0	68	68	0
9	25	100	0	15	117	29	28	142	70	46	147	113	48	137	137	41
10	49	85	0	2	64	10	3	119	58	0	7	5	0	53	53	2
11	53	10	0	0	114	41	7	62	33	2	34	27	2	55	55	2
12	9	18	0	1	24	7	5	19	9	1	25	17	2	20	20	2
13	2	13	0	6	6	1	2	16	5	2	14	10	7	14	14	6
14	15	17	0	6	20	3	5	16	6	5	15	14	5	25	25	10
15	60	55	0	0	82	20	2	121	59	5	30	20	0	37	37	0
16	21	27	0	0	29	3	1	35	12	0	8	6	0	46	46	0
17	27	76	0	3	25	1	0	99	49	3	10	8	0	50	50	0
18	3	7	0	0	9	3	2	10	5	2	7	6	1	7	7	0
19	24	40	0	3	40	8	2	73	39	0	16	11	3	18	18	0
20	56	40	0	0	132	42	0	13	7	0	144	108	4	82	82	4
21	9	33	0	8	28	6	6	30	14	8	19	15	4	22	22	6
22	50	52	0	2	123	39	3	32	17	2	152	114	0	82	82	0
23	63	195	0	10	101	12	18	264	131	13	14	10	2	123	123	2
24	41	154	0	19	141	32	27	177	88	13	114	85	17	125	125	7
Total	690	1243	0	90	1481	366	146	1768	884	164	1143	858	119	1289	1289	106

Table 2 gives a distribution of the six children who worked by the trial and error method of approach, Form B. A study of the table will show for the six children a total score of 4080 seconds in time, of 1790 unclassified errors, of 886 logical errors and 412 perseverative errors. The corresponding average scores for the group based on the 99 repetitions made were respectively 41.2 seconds, 18.1 unclassified errors, 7.9 logical errors and 4.2 perseverative errors. In comparison with the scores for Form A the time per repetition for this group was one and a half times as long; there were twice as many unclassified and logical errors in a repetition and more than eight times as many perseverative errors.

However in a group as small as this individual differences may largely account for this seeming difference. The larger average times taken is partly accounted for in that a repetition was not completed until all the ringing bolts were found and sometimes a child would keep touching the ringing bolts found without trying to find all of them. One of the six, subject 22, a four year old boy, completed the learning. His record is included with the five completing Form A.

The reductions in time for successive repetitions for all children in II Forms A and B are clearly shown by the average scores for each repetition which are given in table 5. The average time for the first repetition was 76.4 seconds; for the 60th trial 19.5 seconds. The reduction in errors with successive trials are also given in this table. The variability in decrease is to be explained by the dropping out of those children who completed the learning. Figure 5 shows these same reductions at intervals of ten repetitions.

TABLE 4

Distribution of number of correct responses for each subject in each row Forms A and B. a-6, etc. refer to the letter of row on board and position in row of ringing bolts.

Subject	Trials	Number of correct responses					Total	Per cent correct
		a-4	b-2	c-5	d-1	e-3		
1	9	2	0	0	0	0	2	4.4
2	14	0	1	1	2	0	4	5.7
3	28	2	0	3	23	0	28	20.0
4	13	0	1	4	0	0	5	.7
5	25	14	2	3	13	7	39	31.2
6	53	19	10	5	36	2	72	27.1
7	7	0	0	0	0	0	0	0
8	34	0	0	33	0	0	33	19.4
9	25	0	0	0	0	0	0	0
10	49	17	11	11	46	25	110	44.9
11	53	43	9	26	41	24	143	53.5
12	9	2	1	1	0	1	5	11.1
13	2	0	0	0	0	0	0	0
14	15	11	5	8	9	8	41	54.6
15	60	37	11	26	46	40	160	53.3
16	21	10	4	4	19	6	43	40.9
17	27	3	3	3	8	3	20	14.8
18	3	0	0	1	0	1	2	13.3
19	24	5	3	0	19	12	39	32.5
20	56	20	7	51	21	17	116	41.4
21	9	1	3	1	5	2	12	26.7
22	50	6	6	39	9	8	68	27.2
23	63	1	0	0	59	3	63	70.0
24	41	0	0	0	16	0	16	7.8
Total	690	193	77	220	372	159	1021	

In figure 6 the learning scores for time and unclassified errors of the six children who completed the learning, five in Form A and one in Form B are shown. A downward curve again appears for both time and errors, with the error score also showing an irregularity between the 30th and 40th repetitions. This irregularity may be partially explained by the effect of individual differences in so small a number of subjects.

Figures 7 and 8 show individual learning curves of two of the subjects who successfully completed the learning. Both show a rapid decrease of both time and errors in the later repetitions.

Summary. Learning as shown by the decrease in time and errors was shown by all children taken individually, both by those who completed the learning successfully and also by those who did not quite complete it within the limits of the experiment.

TABLE 5

Distribution of averages of time in seconds and classified errors for each repetition in II, Forms A and B.

Trials	Time	Errors		
		UC	L	P
1	76.4	17.2	9.7	4.0
2	55.9	13.9	7.2	2.0
3	50.7	15.3	7.6	2.1
4	46.4	14.4	7.0	1.7
5	34.7	12.8	6.5	1.2
6	33.4	11.4	5.9	.7
7	37.7	12.2	6.2	.7
8	36.4	10.2	5.4	1.0
9	29.4	10.7	5.2	1.2
10	28.8	10.5	4.9	.8
11	30.0	10.8	5.6	1.1
12	26.8	10.5	5.1	.3
13	29.7	11.4	5.6	.3
14	26.8	10.6	5.5	.2
15	21.7	8.7	4.4	.2
16	28.4	9.7	4.5	.9
17	26.0	10.8	5.4	1.6
18	23.5	8.8	4.1	.6
19	24.7	10.6	5.5	2.3
20	26.5	9.4	4.7	.3
21	25.7	8.1	4.1	.1
22	27.0	12.1	5.4	1.8
23	22.4	9.6	4.6	.3
24	22.6	9.9	5.0	.5
25	18.5	10.4	4.9	.9
26	18.4	8.4	3.9	.3
27	20.7	9.3	4.4	.5
28	22.6	9.7	4.7	.5
29	19.4	7.6	4.2	.1
30	20.4	9.6	4.7	.4
31	19.6	10.5	5.3	1.3
32	17.4	8.6	4.1	.1
33	23.3	8.0	3.9	0
34	19.0	8.4	4.1	0
35	15.4	7.5	4.1	.1
36	18.3	9.1	4.1	.8
37	20.1	9.4	4.8	.8
38	18.5	7.9	4.0	.6
39	20.6	8.6	4.0	1.3
40	19.9	7.6	3.5	0
41	17.6	7.5	3.5	.1
42	20.1	5.7	2.9	.2
43	16.0	6.7	2.9	.3
44	16.6	4.7	2.4	0
45	22.9	5.7	2.4	.5
46	15.3	4.4	1.9	1.0
47	14.7	3.3	1.4	0
48	15.7	3.5	1.4	0
49	20.0	4.9	2.4	0
50	15.8	4.3	1.7	0
51	17.6	4.4	1.8	0
52	15.2	4.0	1.6	0
53	16.4	4.6	1.8	.2
54	12.7	3.3	1.3	0
55	14.3	3.6	1.3	0
56	12.7	4.3	1.3	1.0
57	15.0	5.5	2.5	0
58	18.5	7.0	3.5	0
59	23.0	6.0	2.0	1.0
60	19.5	4.5	1.5	0
61	22.0	7.0	1.0	0
62	15.0	8.0	2.0	0
63	40.0	10.0	3.0	0

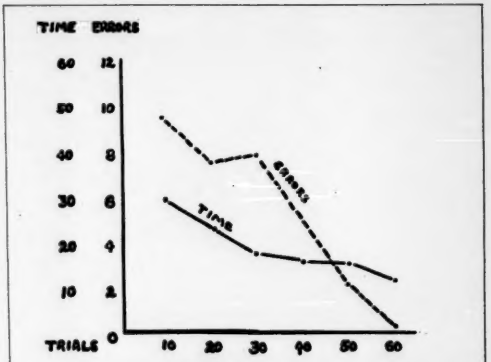

Figure 6.
Learning curves for time and unclassified errors based on averages scores of five children who successfully completed the learning problem in II, Form A and one who completed II, Form B. ——Time. ----Unclassified errors.

Figure 5.
Learning curves for time and errors based on group averages for II, Form A and B. ——Time. ---- Unclassified errors. -·-·-Logical errors.

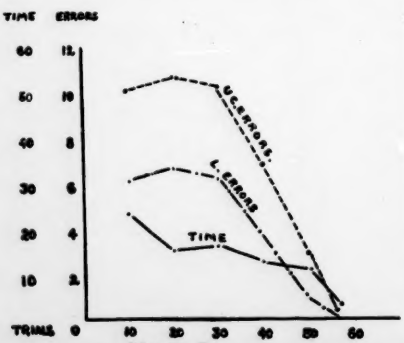

Figure 7.
Learning curve for time and errors of subject 16 who completed II, Form A. ——Time. ---- Unclassified errors. -·-·-Logical errors.

Figure 8.
Learning curve for time and errors of subject 22 who completed II, Form B.

EXPERIMENT III

The third and last experiment in this investigation differed in that a work limit rather than time limit was employed for each sitting. Otherwise the procedure was similar to that in I and II with the exception of a modification of the instructions. This group consisted of thirty-five children, twenty boys and fifteen girls, whose ages ranged from 2 years, 4 months, to 5 years, 2 months. The problem was new to all but five of the children.

Five trials were made in one sitting and the sittings occurred twice a week. A different schedule of ringing bolts was arranged so that bolts a-3, b-1, c-5, d-2 and e-4 made the pattern to be learned. These were the third bolt in Row A, the first bolt in Row B, the fifth bolt in Row C, the second bolt in Row D and the fourth bolt in Row E.

Directions to the child were further defined and the procedure was as follows: At the first trial the board was shown to the child as he stood in front of it with the 25 bolts exposed, then the experimenter began: "See these buttons. Some will make a bell ring when you touch them with this rod." The experimenter covered with cardboard all except the top row then said: "Watch me find the button that rings in this row," (beginning at the left and touching each button with the stylus until the fourth bell rang). "Here it is. This is the only one to ring in this row. If I touch the others they will not ring. See." As she touched the remaining one in that row she said: "Only one in this row rings,now you find it." The stylus was put in the child's hand and if he made a move to begin at the right he was told: "Wait, begin over here." If he moved to continue after finding the bell, the experimenter said: "Stop now. Only one bell in each row rings. Let's try another row." This time all rows except the middle one was covered and the child was told: "Find the bell that rings in this row." The same procedure was followed in having the child begin at the left and stop when he found the bell. The cardboard was then removed and pointing to the bottom row at the left the experimenter said: "Begin here and find the bell in each row that rings." No more instructions were given, except to say "Go and find the bell," if the child stopped, or to show him the next row, if he tended to go elsewhere. This was done only on the first trial. Record of the performance of the child was kept as in the preceding experiments.

The totals for repetitions, time and errors of the 35 children who took part in this third experiment are given in table 6. Here will also be seen the chronological age distribution and the intelligence quotients as found by the Stanford Revision of the Binet-Simon Scale. In this group three two-year-olds were available for trials at the problem and a larger number of three-year-olds for more trials than it was possible to obtain in the second experiment.

In table 7 is shown the distribution of errors for each subject according to rows. The bolts ranked according to fewness of errors are a-3, b-1, e-4, d-2, and c-5. Row c where the fifth and last bolt was the ringing one occupied the same rank as in the second experiment, while the middle bolt in the bottom row occupied the first rank. When the order of the ringing bolts is taken from table 8, they become in the order of times found respectively b-1, a-3, e-4,c-5, and d-2. Thus the first bolt in a row was found the greatest number of times and the second bolt in a row the fewest number of times whether this latter bolt was in Row b or in Row d as occurred in the two schedules used.

Individual Variations. Five of the children in this group had taken part in the second experiment one year before when they were three years old as indicated in table by r. In this third experiment three learned the problem successfully but two were unable to complete the problem. The younger children varied more widely as to method of procedure and tended to touch the bolts in columns as well as in rows.

TABLE 6

Distribution of subjects in Experiment III as to chronological age; intelligence quotient, trials, time in seconds and classified errors. (r) -- These children took part in II. DNC-did not complete.

Subject		CA	IQ	Sittings	Trials	Time	Errors			
							UC	L	P	
1		2-4	131	8	30	2303	353	188	37	DNC
2		2-7	131	4	15	1238	178	83	22	DNC
3		2-8	168	17	85	3155	880	436	58	DNC
4		3-0	137	12	60	1974	767	440	28	DNC
5		3-4	130	7	35	899	367	216	9	DNC
6		3-7	114	4	13	1052	159	76	18	DNC
7		3-7	128	17	85	2832	989	428	50	DNC
8		3-8	97	9	45	1631	470	269	15	DNC
9		3-9	111	15	80	2185	741	366	41	DNC
10		3-10	100	11	55	1726	572	251	8	DNC
11		4-0	158	8	40	844	388	232	11	DNC
12	r	4-0	127	12	63	1070	334	147	15	
13		4-0	133	20	100	2911	1051	545	68	DNC
14		4-1	126	7	36	791	178	100	3	
15		4-2	96	6	30	1550	303	127	24	DNC
16		4-2	125	13	66	1348	438	264	5	
17		4-2	129	10	49	1335	393	231	2	
18	r	4-3	142	5	26	484	110	58	2	
19		4-3	120	9	45	1365	447	269	24	DNC
20		4-4-	130	8	40	929	347	232	4	DNC
21		4-4	113	1	45	1227	390	223	23	DNC
22		4-4	100	10	50	1385	430	290	14	DNC
23		4-4	138	6	30	1028	350	174	62	
24	r	4-5	111	8	38	621	244	127	8	
25		4-5	110	13	64	1234	485	295	9	
26		4-5	100	20	100	2078	648	297	8	
27	r	4-6	121	7	35	814	294	203	2	DNC
28		4-6	113	16	79	1444	491	342	15	
29		4-7	137	13	65	1106	408	160	15	
30	r	4-9	105	15	75	1906	558	332	25	DNC
31		4-9	115	6	28	575	104	59	8	
32		4-10	100	7	36	910	308	145	3	
33		4-11	116	8	41	682	200	98	8	
34		4-11	87	4	20	347	111	62	2	
35		5-2	113	3	15	291	142	93	1	DNC
Total				339	1719	47270	14628	7858	647	
Average						27.5	8.5	4.5	.4	

Reduction in time with successive repetitions for all children in this experiment is also shown by the averages as illustrated in figure 9. The average time for the group for the first repetition was 50.0 seconds and for the 100th repetition was 21.0 seconds. Reductions in errors also were found for unclassified, logical and perseverative errors respectively of 11.4 to 8.0, of 6.3 to 2.0 and of 0.7 to 0. Figure 10 shows curves of reductions in time and errors at intervals of ten repetitions for those completing the problem. The rise in the curve after the 80th trial may be largely explained by the dropping out of subjects requiring the fewer number of repetitions for completion of the problem and the small number of subjects remaining. None of the two and three year old children completely learned the problem.

TABLE 7

Distribution of classified errors for each subject for each row in Experiment III. UC - unclassified; L - logical; and P - perseverative.

Subject	Trials	Errors for each row. a			b			c			d			e		
		UC	L	P	UC	L	P	UC	L	P	UC	L	P	UC	L	P
1	30	45	0	3	87	27	13	90	44	10	60	43	6	74	74	5
2	15	32	0	5	41	11	6	45	19	8	30	23	3	30	30	0
3	85	137	0	4	213	67	25	175	95	3	235	154	20	120	120	6
4	60	88	0	2	125	50	6	218	111	13	172	115	2	164	164	5
5	35	64	0	0	14	3	2	143	71	6	42	38	0	104	104	1
6	13	21	0	1	52	16	7	28	13	5	39	28	4	19	19	1
7	85	177	0	3	348	91	29	80	35	9	265	183	2	119	119	7
8	45	93	0	3	25	6	7	168	85	2	60	54	3	124	124	0
9	80	140	0	5	116	34	14	222	106	2	156	119	13	107	107	7
10	55	103	0	0	205	55	4	31	15	0	159	107	1	74	74	3
11	40	74	0	1	26	8	3	107	58	0	72	57	7	109	109	0
12	63	20	0	0	109	20	4	155	79	8	23	21	3	27	27	0
13	100	175	0	5	163	47	25	341	169	23	179	136	11	193	193	4
14	36	23	0	0	12	3	1	63	29	1	46	34	1	34	34	0
15	30	57	0	1	70	22	5	87	41	10	78	53	8	11	11	0
16	66	106	0	0	5	1	0	120	65	4	74	65	1	133	133	0
17	49	64	0	0	25	6	0	150	74	1	49	46	1	105	105	0
18	26	5	0	0	39	9	2	4	2	2	45	30	0	17	17	0
19	45	75	0	1	12	3	1	161	80	8	73	60	12	126	126	2
20	40	26	0	0	21	6	2	144	72	2	43	41	0	113	113	0
21	45	36	0	1	79	21	10	93	45	4	96	71	6	86	86	2
22	50	48	0	2	34	12	6	136	72	0	74	68	5	138	138	1
23	30	68	0	5	68	15	15	70	34	14	74	55	16	70	70	12
24	38	38	0	0	6	2	0	121	53	6	43	36	2	36	36	0
25	64	81	0	1	16	6	0	179	89	2	79	70	6	130	130	0
26	100	71	0	1	229	61	6	86	44	1	238	168	0	24	24	0
27	35	6	0	0	22	5	1	132	65	1	38	37	0	96	96	0
28	79	15	0	0	2	0	0	227	110	12	108	93	2	139	139	1
29	65	100	0	0	74	21	5	170	84	9	45	36	1	19	19	0
30	75	31	0	0	40	10	8	305	149	15	88	88	2	94	94	0
31	28	12	0	0	25	8	2	20	9	3	23	18	1	24	24	2
32	36	50	0	0	92	23	0	24	11	0	92	61	1	50	50	2
33	41	53	0	1	5	1	0	83	42	6	30	26	1	29	29	0
34	20	26	0	1	11	2	1	22	11	0	20	17	0	32	32	0
35	15	15	0	0	3	2	0	59	28	1	30	18	0	45	45	0
Total		2175	0	46	2414	674	210	4259	2129	191	2978	2269	141	2815	2815	61

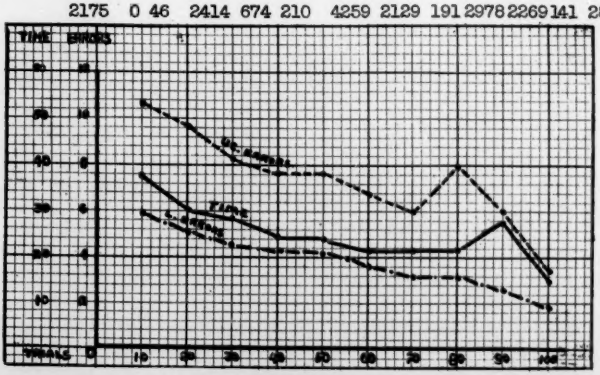

Figure 9.
Learning curves for time and errors based on average scores for Form III.

TABLE 8

Distribution of correct responses for each subject for each row in Experiment III.

Subject	Trials	Correct responses for each row					
		a-3	b-1	c-5	d-2	e-4	Total
1	30	7	2	2	0	1	12
2	15	2	2	1	1	1	7
3	85	15	10	8	5	32	70
4	60	16	3	4	1	1	25
5	35	3	29	0	1	0	33
6	13	1	0	3	1	6	11
7	85	5	1	56	0	2	64
8	45	1	38	0	3	0	42
9	80	13	48	12	3	40	116
10	55	3	4	45	1	0	53
11	40	2	30	7	1	1	41
12	63	53	18	9	47	53	180
13	100	19	50	6	14	31	120
14	36	23	13	17	9	19	81
15	30	4	6	4	1	21	36
16	66	7	64	30	10	20	131
17	49	18	35	7	8	11	79
18	26	23	15	23	6	12	79
19	45	7	41	1	2	1	52
20	40	27	34	4	2	0	67
21	45	25	25	17	1	2	70
22	50	26	39	6	3	0	74
23	30	6	10	9	10	10	45
24	38	12	33	3	10	19	77
25	64	24	56	15	9	19	123
26	100	63	35	61	12	79	250
27	35	32	26	0	0	3	61
28	79	70	77	22	6	28	203
29	65	15	40	15	37	53	160
30	75	58	61	1	6	39	165
31	28	22	19	22	12	18	93
32	36	11	9	29	4	3	56
33	41	12	32	14	21	27	106
34	20	7	16	13	7	8	51
35	15	6	13	0	0	0	19
Total	1719	638	934	466	254	560	4571

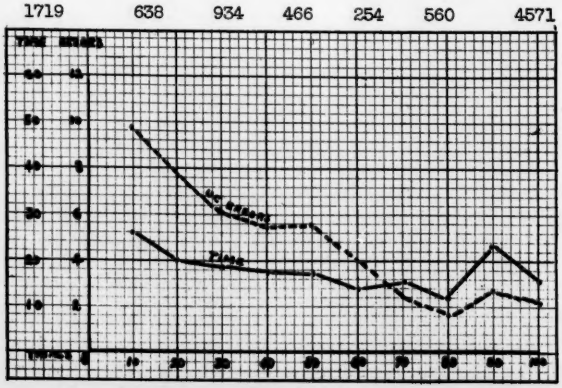

Figure 10.
Learning curves for time and unclassified errors based on average scores of 15 children who successfully completed Form III.

Fifteen four year old children from this group successfully completed the learning in this experiment to the extent of three successive errorless repetitions. Only one child required more than 80 repetitions. He completed the problem in 100 repetitions.

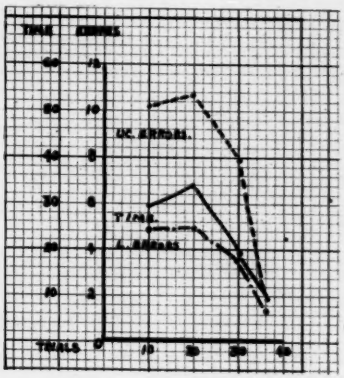

Figure 11. Learning curves for time and errors of subject 32-III

Individual learning curves of four children are given in figures 11 and 12. All show a decided reduction in time and errors, as well as differences in repetitions required. The rise at the 40th trial in the curve of subject 16-III may be explained by a prolonged absence of 77 days.

Ten of the fifteen children who learned the problem in Form III relearned it, one after a period of two months and nine after a period of one week. In every instance there was a decided decrease in repetitions and in time and error scores. Further evidence of a rational approach to the problem was given in that only one perseverative error occurred in all the 93 repetitions made by the ten children. Logical errors were next in rate of decrease. Three of the ten children made no logical error and two made only one each.

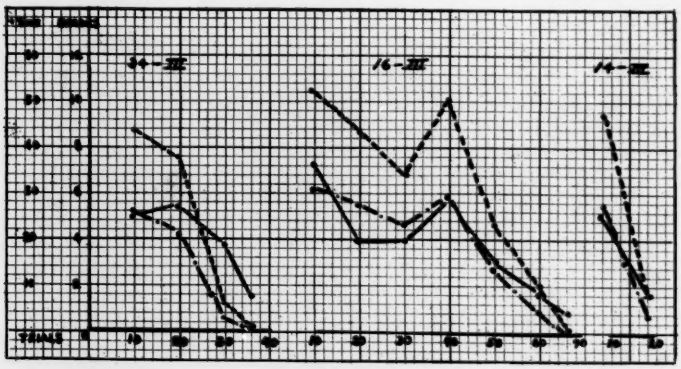

Figure 12.
Learning curves for time and errors of subject 34-III, 16-III, and 14-III. —— Time. ----- Unclassified errors ·—·—Logical errors.

Individual differences continued to have decided influence in this somewhat larger group of children in the third experiment. Results on the whole further strengthened the findings of the earlier experiment in relation to decrease in errors and in time required as the learning progressed. Particularly do the decreasing logical and perseverative error scores in the relearning seem to give further evidence of the ability of these children to use a rational organization of material such as this in the solution of a problem.

Comparative Analysis of the Three Forms

It has been shown by investigators that adults presented with a problem whose solution requires an elimination of errors are able to facilitate the solution by a so-called rational organization of material rather than by a trial and error method.

In this investigation it has been demonstrated that young children from two years, 4 months, to 5 years, 4 months, of age gave responses similar to those of adults. They require a longer time for learning and there has been more of the element of trial and error than in the case of adults. With learning distributed over a long period these young children have succeeded in arriving at the point where, through a voluntary choice shown by not touching bolts touched earlier in the experiment, errors have been reduced from the number made when each bolt was touched to the point where none was made and the criterion of three successive errorless repetitions was met.

Grouping errors under the three classifications of unclassified, logical and perseverative errors, it was found that in the early stages of the problem all three classes occurred. The number was determined largely by the child's method of beginning at the edge of the board or at some other point and proceeding in regular order to touch all bolts until he encountered the ringing one. As the learning progressed choices were made, the child not touching bolts that had already been found in that place in other rows and not logically correct.

All three classes of errors persisted to a certain degree even into the later stages but the data show a decrease with practice.

With the larger Haught Board the time required for learning such a complicated pattern and the difficulty of a mechanical nature occasioned by the necessity of such young children having to reach a long distance to touch the bolts in the top row made completion of learning inadvisable for them. They persisted in the problem to such an extent that even in the 24 repetitions a reduction of errors did occur.

With the smaller board of 5 ringing bolts three methods of procedure were followed. Eighteen children working for three minutes at a time attempted to learn the pattern by beginning at a certain place on the board, the bottom row, and proceeding by rows to the top row. Six working three minutes at a time were allowed to begin touching bolts at any point on the board and proceed in any way they wished. A third group of 35 children began at the extreme left in the bottom row and proceeded by rows to the top row. Variations in methods of procedure showed an advantage with regard to elimination of errors for the work limit of 5 trials a sitting over the time limit of 3 minutes of practice in one sitting.

The greatest number of errors was made with the trial and error form when the child was free to find the bells in any way he chose. Within the limits of the experiment only one child successfully completed the learning by the trial and error method of procedure. However, he attached the problem vigorously and reached the criterion of success in an exceptionally small number of repetitions. Comparing the work limit of 5 trials at a sitting with the time limit of 3 minutes of practice, the latter has a slight advantage as regards the number of trials made by those successfully completing the experiment.

Of the twenty-one children from all groups who learned the problem to the extent of making three errorless repetitions 10 relearned it after an interval of one week according to the same criterion of success. Nine of these children made no perseverative errors. The total score for these ten was one perseverative error. Three of them made no logical error while the individual scores of all were reduced in every instance. Two children relearned the problem after an interval of two months. Their perseverative error scores were practically the same ,while

their logical error scores were very greatly reduced.

SUMMARY AND CONCLUSIONS

In this study of a learning problem that permitted selection of response by the child and a rational method of solution sixty-seven children were tested. There were 42 boys and 25 girls. Three forms of procedure were used though the problem remained essentially the same.

The actual time required for such a problem does not appear to be as significant a measure as the number of errors. The time is a function of the method of attack upon the problem and the wide differences among individuals as to methods employed at various stages of learning would invalidate direct comparisons.

The errors have been grouped as logical, perseverative or unclassified. In the initial stages of learning the logical and perseverative errors are frequent but they decrease more rapidly than the unclassified errors do. The total number of errors made appears to be the best criterion of learning. The elimination of logical errors does show the ability of children as young as three years to use the method of learning termed rational for adults.

Learning appeared to be facilitated in part by the position of the ringing bolt on the board. There was a tendency for the first bolt in a row to be found more frequently without error and also for the correct bolt in the first row and in the last row to be learned earlier than those in the intermediate rows.

Ability to complete the problem and to make a rapid improvement in elimination of errors increases with age. No two-year-old child succeeded in making a final correct response within the limits of the experiment but almost attained success. The closing of the school interfered with their achieving the stage of efficiency set as a criterion. Children who were exactly 4 years of age at the beginning of the experiment did succeed. The number of repetitions necessary for solution decreased with the age of the child with some exceptions. It does appear that a child who shows greater ability in other performances such as give higher intelligence quotients also makes more rapid improvement in this form of learning.

Wide individual differences in performance occurred as measured by the time taken and by the number of errors occurring. This was noted for all children, for those successfully learning the problem and for those partially completing it. Study of the individual records of children in this form of learning shows that the trial and error method of the initial stages is replaced by a rational organization of material.

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HEIGHT, WEIGHT, AND AGE TABLES FOR HOMOGENEOUS GROUPS

With Particular Reference to Navaho Indians and Dutch Whites

MORRIS STEGGERDA and PAUL DENSEN[1]

INTRODUCTION

Height and weight tables are used extensively throughout the United States by individuals, schools, insurance companies, and other organizations. Most of these tables are made up without consideration of racial characteristics. Popular data for the average American child are gathered from all races and nationalities. Thus the short Greek and the tall Swede go to make up this average, and then Indian, negro, white and other children are all compared with this "patch-quilt" average.

If the weights of these individuals are referred to these tables for comparison some consideration of this procedure should be taken since misinterpretation of the results may occur when it is overlooked. For example, among the Pueblo Indians in the southwestern part of the United States, it was found that the Indian children were considered underweight when compared with average weights set up in tables of the type described above. They were fed cod-liver oil and fattening foods in order to combat this situation but with little avail.

Among the Navahos the season of the year is also important. When the children enter the boarding schools, for example, after living a nomadic existence of two or three months with their parents, they immediately gain in weight. Thus not only the racial group should be considered but also the local characteristics of the population should be mentioned.

The compilation of separate height and weight charts for homogeneous racial groups was first suggested when the data of Gray and Ayres (1931) on white children in private schools, Baldwin's data (1921) on public school children, and those of Porter (1894) on white children in St.Louis were plotted together in one graph. These curves (Chart I) differ consistently from one another. In other words, there are three differenct sets of averages for three different groups of individuals, all of whom are of the same race. When individuals are compared with some given standard it is assumed that the same forces which operated to produce the standard operate upon the individual. This is only necessarily true when the standard used is made up from the individuals with whom it is compared. Hence it was deemed preferable, when homogeneous groups were available, to prepare height and weight tables specifically for each group. It is the purpose of this paper to present such tables specific for the Navaho Indians in the schools of the southwest and for Dutch white school children of Holland, Michigan.

MATERIAL AND METHODS

The anthropometric data for the Indian children were collected from schools on the Navaho reservation in New Mexico and Arizona. These include government boarding schools, some day schools, and the mission boarding schools. Care was taken to select those children who were relatively pure Navaho, e.g. those who were known to have any white blood were excluded from this study. The data for the Dutch white children were collected in the schools of Holland,Michigan, and only those whose ancestors came from the Netherlands were used in making the table.

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The authors are indebted to Dr.Margaret Merrill and Dr.C.E.Palmer, of the Department of Biostatistics, School of Hygiene and Public Health, Johns Hopkins University, for suggestions and criticisms in this study.

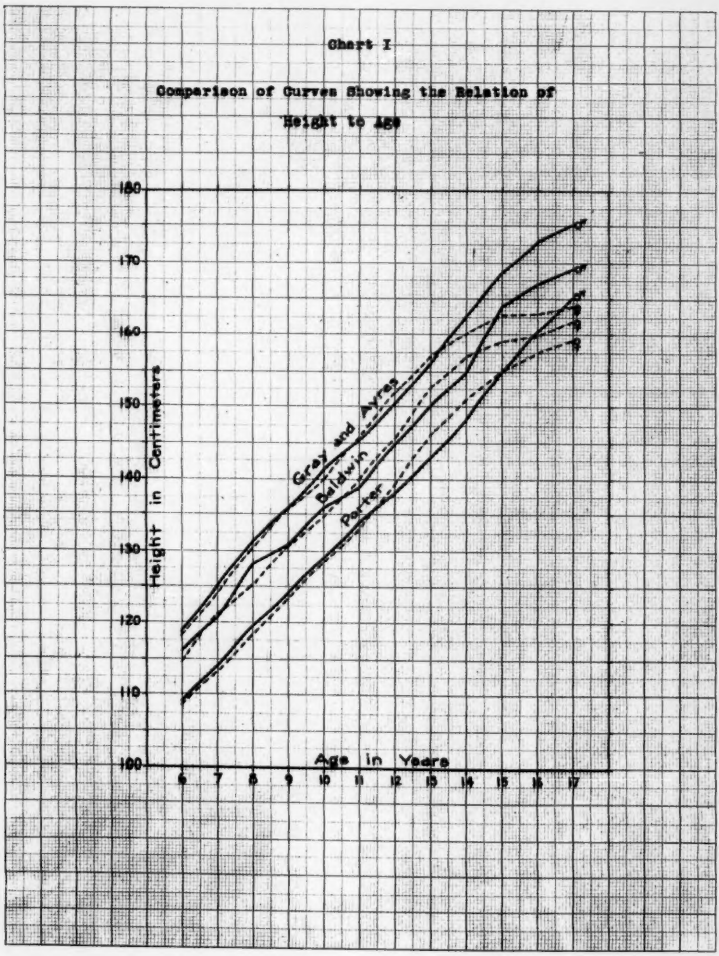
Chart I
Comparison of Curves Showing the Relation of Height to Age
Height in Centimeters
180
170
160
150
140
130
120
110
100
Gray and Ayres
Baldwin
Porter
Age in Years
6 7 8 9 10 11 12 13 14 15 16 17

A total of 3332 Navaho boys and girls between the ages of six and eighteen were measured. The Dutch whites measured numbered 3730, between the ages of six and fifteen. Believing that the mean heights and weights for children of these two races by ages would be useful to anthropologists we supply Table 1.

The method of taking measurements was as follows: For taking height the subject was told to stand erect, with heels close together, the head being held in the "Frankfort horizontal." The anthropometer was held as closely to the vertical position as possible, and the rod left unsupported for a fraction of a second, so as to test its verticality. The distance from the highest point of the head to the floor was considered the vertex height, or stature.

All weights were taken on a portable balance scale. Clothing was reduced to a minimum, with shoes prohibited. Boys and little girls were generally weighed in their underclothing; older girls in nightgowns in the dormitories. The average weight of this minimum clothing was taken and subtracted from the given weight.

Age was taken to the nearest birthday for both groups. However, in the case of the Navahos where birth dates are not always available, the school records were checked against the age stated by the child, and where a variation of two or more years occurred, the measurements were omitted.

Height and weight tables are usually prepared by computing the average weight for a particular age and height class. This was done in the present study by computing equations of average relationship between height and weight by the usual least-squares method and then substituting specific heights in the equations to obtain average weights for these heights.

In computing these equations it was assumed that the relationship between height and weight is of a linear nature. That this assumption is permissible is shown by a comparison, for each of the ages studied, of the correlation coefficient with the correlation ratio by means of Blakeman's test. The difference between the two coefficients was not statistically significant.

In order to facilitate the computations it was decided to use distributions of fifty individuals drawn at random in each age and sex class rather than the larger distributions. The largest probable error of the means for weight in the distributions of fifty individuals was 2.2 pounds in the 15 year old class for Dutch boys. This is a small degree of variability, when the accuracy required in the use to which these tables are put, is considered. Moreover the variability of weight tends to increase with age and this is the highest age class for the Dutch.

RESULTS

It will be seen from Plate I and Chart II that the weight prediction for the Navahos is less than that for the Dutch whites. This may be explained on a racial basis. However, the Dutch have smaller weights than those of a usual height and weight table for American whites of the type referred to in paragraph 1, prepared by Mead and Johnson. The reason for this is difficult to explain except that the Dutch as a race are tall and of a rather slender build, and thus, although tall do not necessarily weigh more. This illustrates again the importance of height and weight tables for homogeneous groups. Further, the sex difference for weight in this Dutch series is not as large as is found in the height and weight table of Mead and Johnson.

Most height and weight tables give the heights and weights for average individuals. However, practically all individuals deviate from the average to some extent. An auxiliary table of average deviations for each age and sex is supplied on each of the height and weight tables.

Chart II

Comparison of Curves for Weight

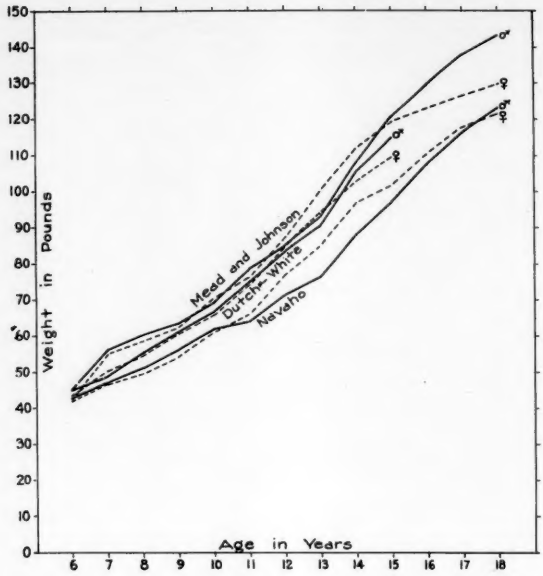

TABLE 1

Mean Heights and Weights for Navaho and Dutch Children

	Navaho						Dutch					
	Boys			Girls			Boys			Girls		
Age	No.	Height	Weight	No.	Height	Weight	No.	Height	Weight	No.	Height	Weight
6	75	45.69±.16	44.34±.37	65	44.65±.15	41.85±.39	144	46.20±.10	45.34±.28	137	46.04±.12	44.19±.38
7	101	47.56±.15	47.65±.41	99	46.87±.13	46.65±.38	220	48.55±.10	50.59±.31	188	48.24±.10	49.53±.34
8	132	49.50±.11	52.76±.37	104	48.78±.13	50.75±.44	232	50.79±.10	55.15±.31	204	50.40±.10	54.82±.37
9	143	51.63±.12	57.67±.39	133	51.15±.13	56.25±.43	221	53.03±.10	61.69±.36	180	52.13±.13	61.20±.56
10	186	53.28±.10	62.51±.33	153	53.10±.11	62.30±.40	192	54.80±.12	67.24±.51	204	54.61±.13	66.12±.54
11	153	54.67±.11	66.81±.47	145	55.21±.12	68.73±.50	189	56.81±.12	74.46±.52	177	56.85±.14	74.63±.72
12	185	56.28±.11	72.14±.43	144	56.65±.11	76.17±.58	184	59.01±.12	82.93±.79	161	59.47±.16	84.58±.91
13	197	58.75±.12	80.43±.55	168	59.12±.10	85.75±.65	183	61.13±.15	90.45±.82	213	61.87±.14	95.22±.94
14	196	60.56±.12	90.65±.59	153	60.28±.10	95.89±.65	192	63.83±.16	101.09±.89	207	63.55±.13	103.98±.83
15	133	63.18±.13	99.71±.73	136	61.14±.10	104.98±.71	149	66.39±.19	111.40±1.08	153	64.08±.12	107.46±.92
16	103	65.17±.12	110.01±.73	111	61.55±.09	112.50±.73						
17	83	65.96±.12	118.81±.76	79	61.95±.12	115.10±.98						
18	76	66.72±.14	123.91±.84	79	62.00±.13	118.71±1.05						

Height is in inches; weight in pounds

Plate I.

A HEIGHT WEIGHT AGE TABLE FOR NAVAHOS 6 TO 18 YEARS

BOYS

HEIGHT INCHES	AGE IN YEARS												
	6	7	8	9	10	11	12	13	14	15	16	17	18
41													
42		38											
43	38	39	38										
44	40	40											
45	42	42											
46	44	44	45										
47	45	46	46	46	46	46							
48	47	48	48	48	48	48							
49	49	50	50	50	50	50							
50	51	51	52	52	53								
51	52	53	54	54	55	55							
52		55	56	57	58	58	58	59					
53			57	59	60	60	61	63					
54				61	62	62	63	63					
55				64	65	65	65	66					
56					67	67	68	69					
57					69	69	72	72	72				
58						72	75	75	76	76	76		
59						75	78	78	80	80	82		
60						82	82	82	83	84	87		
61							85	85	87	88	92		
62									89	91	96		
63									92	95	100	105	111
64										99	104	109	115
65										103	108	113	118
66										107	113	118	121
67										111	117	120	123
68											121	124	126
69											125	128	129
70											128	131	131

GIRLS

HEIGHT INCHES	AGE IN YEARS												
	6	7	8	9	10	11	12	13	14	15	16	17	18
41	32												
42	33	33											
43	34	34											
44	35	36	36										
45	36	38	38										
46	41	41	41	41	41								
47	43	44	44	44	44								
48	46	46	47	47	47								
49	49	50	51	51	51								
50		54	54	55	55								
51		57	57	57	57								
52		61	61	61	61	62							
53		64	64	64	65	65	65						
54		67	68	68	68	69	69						
55				70	72	72	73	73					
56				73	75	75	76	77					
57				76	78	78	80	80	84	88			
58				79	81	83	85	85	89	92	94	98	101
59				82	85	86	89	89	93	95	98	102	103
60				86	89	90	93	93	96	98	101	105	109
61							97	98	100	101	105	109	111
62							101	102		105	108	112	114
63								106	108	109	112	116	117
64									112	113	117	120	121
65												123	124
66													127

AGE	AVERAGE DEVIATION IN POUNDS FROM WEIGHTS IN TABLE	
	GIRLS	BOYS
6	3	2
7	3	3
8	3	3
9	3	3
10	4	3
11	5	4
12	5	4
13	8	5
14	8	5
15	8	7
16	9	7
17	9	7
18	9	7

A HEIGHT WEIGHT AGE TABLE FOR DUTCH WHITES 6 TO 15 YEARS MEASURED IN HOLLAND, MICH.

BOYS

HEIGHT INCHES	AGE IN YEARS									
	6	7	8	9	10	11	12	13	14	15
41										
42										
43		39								
44		41								
45	43	43								
46	45	45								
47	47	47	47							
48	49	49	49							
49	51	52	52							
50	53	54	54	54	54	53				
51	55	56	56	56	57	57	56			
52	57		59	58	59	60	61			
53			61	61	62	62	64			
54				63	64	65	65	67		
55					67	67	69	69	69	69
56					70	70	72	72	72	72
57					72	72	75	75	75	75
58					77	77	78	78	79	79
59							82	82	83	83
60							85	85	86	87
61									90	91
62									93	95
63									97	100
64									102	105
65									107	109
66										114
67										118
68										122
69										127
70										132
71										136
72										141
73										146

GIRLS

HEIGHT INCHES	AGE IN YEARS									
	6	7	8	9	10	11	12	13	14	15
41	33	33								
42	34	34								
43	37	36								
44	39	40	40	40						
45	41	42	42	42						
46	43	44	44	44						
47	45	46	46	47	47					
48	47	48	48	48	48					
49	49	51	51	51	52					
50	51	53	53	53	54	54				
51	53	55	55	55	56	56				
52	55	57	58	58	58	58				
53		60	61	61	61	61	61	61		
54		63	63	64	64	64	64	64		
55		66	66	66	67	67	68	68		
56			69	69	69	71	72	72		
57			72	72	72	75	75	76		
58			76	75	76	78	78	80	83	
59					79	83	83	83	87	
60					82	86	88	87	90	
61						90	91	91	94	96
62						93	95	95	98	102
63						95	98	100	102	106
64							102	103	105	108
65							105	107	108	110
66							108	110	112	113
67								114	115	115
68								118	119	119
69									122	122

AGE	AVERAGE DEVIATION IN POUNDS FROM WEIGHTS IN TABLE	
	GIRLS	BOYS
6	3	3
7	3	3
8	4	4
9	4	4
10	5	4
11	7	6
12	7	6
13	11	8
14	11	8
15	11	10

These deviations were obtained by averaging the differences between the actual weights of a given age and sex class. It will be noted that the average deviation for the younger ages is not as large as for the older ages.

These average deviations may be interpreted as follows: A particular eight year old Dutch boy, fifty inches tall, weighs fifty-eight pounds. The average weight for boys of his age and height is fifty-four pounds. Thus he weighs four pounds more than the average. The auxiliary table tells us that this is one average deviation in weight from the weight in the tables. Statistically this means that this particular Dutch boy deviates from the weight in the table more than do 58 out of every 100 similar eight year old Dutch boys. If the same boy deviated from the weight in the table by two average deviations, or eight pounds, he would deviate more than 90 per cent of the people in a similar distribution. Obviously, if 90 per cent of the people are closer to the weight in the table than he, he is considerably over average.

SUMMARY

1) Height and weight tables are presented specific for the Navaho Indians of the southwest and the Dutch whites of Holland,Michigan. Auxiliary tables are presented showing the average deviation from the weights in the height and weight tables.

2) The weights for specific heights in the tables for Navahos and Dutch white children are generally lower than those in a popular type table based on measurements of American children in general prepared by Mead and Johnson.

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MODES OF THOUGHT IN HIGH SCHOOL PUPILS

HERMAN ASCH[1]

Personal and classroom contacts with boys and girls have led me to believe that, barring the mentally defective, there is no such thing as a pupil who cannot be taught. In September, 1934, I found myself in a position which enabled me partly to test the validity of this belief, for I was assigned to teach a class of thirty-two boys and girls who were unsuccessful in their school work.

For this study I used three third term classes: (1) A straight promotion or backward class (register 32); (2) A regular class (register 36); and (3) An honor class (register 32). In the regular and honor classes pupils were promoted on merit, while in the straight promotion class (backward pupils) they were advanced regardless of merit.

Each class was given two tests:

1. A Reasoning Test - The purpose was to determine the number of correct reasons a pupil can give for a stated fact.

2. An Instruction Test - The purpose was to determine the pupil's ability to follow instructions.

In the Reasoning Test the pupils were allowed two and one-half minutes to give as many reasons as they could for each question. The following questions were given:

Question 1.

> During a baseball game the batter struck the ball. Immediately an argument arose, some claiming it a "fair" ball and some a "foul" ball. Give as many reasons as you can to account for the difference of opinion.

Question 2.

> I have observed that the doors of a comfort station are cream colored. Give as many reasons as you can to account for the fact that the woodwork around the door knob of the men's entrance is dirtier than the woodwork around the door knob of the women's entrance.

Question 3.

> The sign in the trolley car reads: "Leave by the rear door to avoid delay," yet we find many people leaving by the front door. Give as many reasons as you can for this.

Question 4.

> Although the request for good manners and clean personal habits is constantly made, pupils are frequently known to lack them. Give as many reasons as you can to account for this.

Question 5.

> All pupils know that to cheat during a test, copy home work, or any such act does not help develop them morally or mentally, yet we frequently find pupils who do this. Give as many reasons as you can to account for this.

[1] From James Monroe High School, New York City.

Herewith are samples of answers to questions 2 and 3 and method of evaluating them with regard to their acceptance or rejection as a reason.

Answers to Question 2.

1. More men use the public comfort station than women.
2. Most women's hands are cleaner.
3. Men do dirtier work.
4. Men are more liable to push the door by resting the hand on woodwork than women.
5. Men's hands are generally dirtier than women's.
6. Average woman cleaner than the average man.
7. Maybe a janitor forgot to clean the men's entrance.

Where answers 3 and 5 appeared on one paper, only one was accepted. Where 2 and 6 appeared on the same paper only one was accepted. Answer 7 was not accepted.

Answers to Question 3.

1. Did not want to go to the back door.
2. Front of car may be less crowded than the rear.
3. Maybe he was sitting near the front door.
4. Wanted to try to save a few steps.
5. Maybe it was bad weather outside and he wanted to get off nearer to the corner.
6. Maybe he just got on and had no time to walk to the back.
7. Did not think.
8. Maybe he wanted to catch the car in front of him.
9. Maybe the front of the car was so crowded he could not reach the back when he entered.
10. He may have been waiting to hear the motorman announce a street.
11. He may have been waiting to ask the motorman a question.
12. He might have met a friend who was seated near the front of the car and had stopped to talk to him.

Answer 1 was not accepted. Where 4, 5 and 8 appeared on one paper, only one answer was accepted. Where 10 and 11 appeared on one paper, only one answer was accepted.

Underlying principle of evaluation:

1. Every possibility accepted as a correct answer.
2. Any number of answers showing similar thought processes were credited as one answer.
3. Answers showing no thought were not accepted.
4. Where opposing answers were given, only one was accepted.

The number of students giving correct responses are shown in Figures 1 to 5. From the graphs we can see that our so-called good pupils cannot analyze a problem from as many points of view as our so-called poor pupils.

In the Instruction Test each pupil was given a piece of ruled white paper and told to put nothing on it but that which he is instructed. For each instruction which was carefully read, he was allowed thirty seconds.

Instruction test.

1. Print your last name on the first line in the upper left hand corner of your paper.
2. Place a comma after your name.

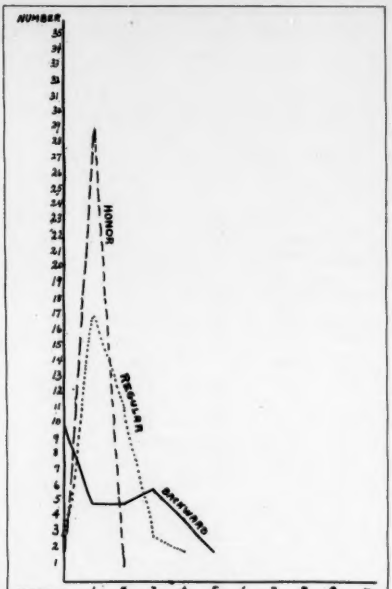

Figure 1.
Question 1. Baseball game.
Distribution of number of reasons given by each group.

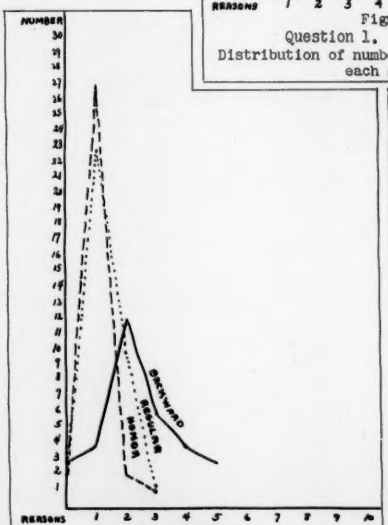

Figure 2.
Question 2. Woodwork around door.
Distribution of number of reasons given by each group.

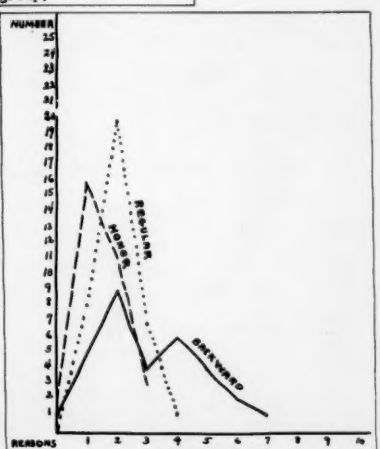

Figure 3.
Question 3. Sign in trolley car.
Distribution of number of reasons given by each group.

3. Write your first name two inches to the right of the comma.
4. On the fourth line below your last name draw a line about two inches long.
5. Two inches to the right of the line just drawn and on the line below it make four circles each about 3/8ths of an inch in diameter.
6. In the center of your paper draw a four inch square.
7. Inside the square draw a line from the center of the top line to the left hand corner of the square.
8. Now draw a line from the center of the top line to the right hand lower corner of the square.
9. In the center of your diagram draw a two inch circle.
10. Print your name inside the circle - last name first.

In studying the answers to these questions I found no errors until I came to the answer to instruction 6. Every one of the 100 pupils made the same error which consisted of making the four inch square in the center of the unused part of the paper instead of in center of the paper as stated.

I am not interested in the right or wrong of the pupils making this error. What does interest me is that 32 poor pupils, 36 regular pupils and 32 honor pupils made identically the same error, thus inferring that there is a common mode of thought and training. No conclusion is drawn from these meagre tests. However, I believe that the results received warrant further investigation.

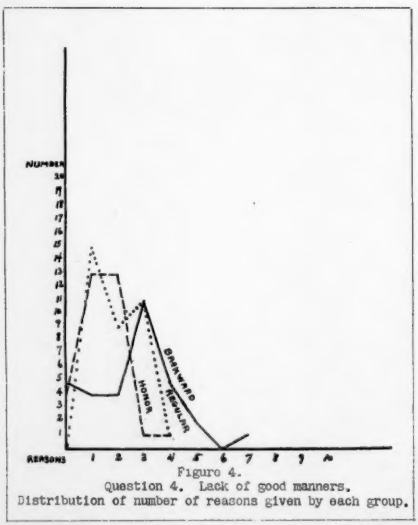

Figure 4.
Question 4. Lack of good manners.
Distribution of number of reasons given by each group.

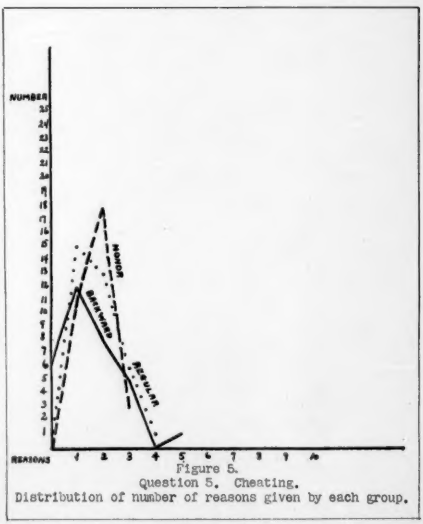

Figure 5.
Question 5. Cheating.
Distribution of number of reasons given by each group.

MOTIVATION OF YOUNG CHILDREN: FURTHER STUDIES IN SUCCESS AND FAILURE, PRAISE AND BLAME

HAROLD H. ANDERSON*

Motivation in this investigation is measured by performance of young children on a hand dynamometer. This study is a continuation of two studies made at the Iowa Child Welfare Research Station and previously reported by Chase[1] and Anderson and Smith[2].

A summary of the procedure of the Chase study taken from Anderson and Smith (p. 138) states the essential background for the problems and data discussed here.

> "The purpose of Chase's investigation was 'to obtain data on the relative effectiveness of a number of different types of external incentives which have been given under controlled and experimental conditions with four comparable groups of children ranging in age from two to eight years.' (2 (Chase) , p. 31) These groups were designated by the letters A, B, C, and D, respectively.
>
> "Each child was given three series of strength tests at intervals of one week on a hand dynamometer devised especially for the Chase study. Each series consisted of seven trials on the strength test; only the scores of the last six were used in the computations. In the first test, Series I, the children in all groups received the same instructions with no knowledge of results, the recording apparatus being concealed behind a screen.
>
> "In Series II, given one week after the first, a separate procedure was followed for each of the four groups. Group A, known as the control group, was given for the first, second, and third weeks the same procedure with no knowledge of results. Individuals in Groups B, C, and D, irrespective of their performance scores, were made to believe the second week (Series II) that through their efforts they had succeeded in ringing a bell which had actually been rung from a button pressed at the appropriate moment by the experimenter's foot. Group B, following the success on each of the seven trials, was given a mere repetition of the instructions: 'I want you to try again. When I say "ready squeeze," I want to see if you can make the bell ring. Ready, squeeze.' Following the success on each of the seven trials, Group C was praised in the language and manner described by Chase (2 (Chase) , p. 67). Group D, following the success on each of the seven trials, was given a reward in the form of a gold star which had been promised on the condition of ringing the bell.
>
> "During the third week the tests and situations in Series III were given. Each child in Group A, as stated, received the same control-motivation as was given in Series I and Series II, that is, no knowledge of results and a mere repetition of instructions. Individuals in Groups B, C, and D, irrespective of their performance scores on the seven trials of this series, were led to believe that they had failed to ring the bell. Group B was given a repetition of instructions as in Series II after failure to ring the bell on each of the seven trials. Following each of

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1 Chase, Lucile: Motivation of Young Children: An Experimental Study of the Influence of Certain Types of External Incentives Upon the Performance of a Task. Univ. Iowa Stud., Stud. in Child Welfare, 1932, 5, No. 3, Pp. 119.

2 Anderson, Harold H., and Smith, Ruth Sloan: Motivation of Young Children: The Constancy of Certain Behavior Patterns. J.Exper.Educ., 1933-1934, 2, 138-160.

the seven successive failures, Group C was reproved as described by Chase (2, (Chase), p. 68). Each child in Group D, after each respective failure, was supposedly punished by having a red button cut off a paper 'gingerbread boy' which had previously been given to him with the warning that the experimenter would be obliged to cut off a button each time he failed to ring the bell."[3]

The tabular form will give a more concise presentation of the plan for the various motivational situations according to groups of children and the successive series of tests administered at weekly intervals:

Group	Series I	Series II	Series III
A	Control-motivation	Control-motivation	Control-motivation
B	Control-motivation	Success-repetition	Failure-repetition
C	Control-motivation	Success-praise	Failure-reproof
D	Control-motivation	Success-reward	Failure-punishment

The apparatus used in collecting additional data for this study was the original motivation hand-dynamometer which was devised to serve two purposes in the Chase study: (1) to enable the experimenter to obtain a record of the amount of force exerted by the child in squeezing the levers, and (2) to control the apparent results of performance seen by the child. A main water and lever system operated by the child served the first; the secondary water system and the train system operated by the experimenter served the second purpose.

The child squeezed two levers which, operating like a pair of forceps, squeezed a rubber bulb in the main water system, forcing red colored water through rubber tubes to an upright glass tube on the side of the apparatus visible only to the experimenter. The height of this column of water could be read from a paper meter scale placed behind the tube. By means of a one-way valve the liquid was maintained at its highest level while the score was being read. The water was then released through a stopcock and permitted to flow back into the main system for the next trial.

When it was necessary in the experiment for the child to believe that he was succeeding or that he was failing, he was shown this apparent performance in one of two ways. The first consisted of the water system operated by the experimenter with a rubber bulb concealed beneath the table and an upright glass tube visible to the child and to the experimenter. The second consisted of a train mounted on a movable lever which permitted it to run in an arc along a track.

Chase used these two methods, the water system for success and the train system for failure, because she believed a change in the appearance of the apparatus would reduce the carry-over from the situation of success to that of failure. When the child was to have no goal and no knowledge of results, as in control-motivation, the train system was removed and the post supporting the two upright glass tubes was covered by a cardboard screen. Under all conditions, the child squeezed the hand levers forcing liquid into the back tube, which was always visible to the experimenter.

[3] See Chase (p. 68) for complete directions and explanation of procedure in giving the three experimental test presentations.

The present study is concerned only with that part of the Chase procedure in which the hand-dynamometer was used.

Chase in her study of 213 children between the ages of two and eight found certain differences in performance among the four motivation groups and between the series in the test situations. Some of these differences were significant, some approached significance, and some were not significant. In general the same tendencies as shown by mean scores were found three years later when 102 of the Chase subjects were retested by the same procedure.

Table 1 adapted from Anderson and Smith (p. 144-146), shows for the 102 children for both the original Chase data and the Smith retest data the differences in mean scores of the groups, the probable errors of these differences, and the critical ratios of these differences.

TABLE 1

Reliability of Differences of Means of Groups in Series I, II, III, I and II, II and III, and I and III for Selected Chase and Smith Retest Subjects

Selected Chase Subjects (Entire Group, 102 Children)				Smith Restst Subjects (Entire Group, 102 Children)			
Group	Mean Difference	Probable error of difference	Ratio of Difference to Probable Error of Difference	Group	Mean Difference	Probable Error of Difference	Ratio of Difference to Probable Error of Difference
Series I							
AI* and BI	.50	.54	.94	AI* and BI	.87	.63	1.36
AI and CI*	.16	.55	.29	AI and CI*	.98	.72	1.35
AI* and DI	.16	.57	.28	AI* and DI	.98	.71	1.37
BI and CI*	.66	.48	1.38	BI and CI*	1.84	.57	3.20
BI and DI*	.34	.49	.69	BI and DI*	1.84	.56	3.32
CI* and DI	.32	.51	.63	CI* and DI	.00	.73	.04
Series II							
AII and BII*	1.71	.58	2.95	AII and BII*	2.76	.73	3.81
AII and CII*	2.21	.62	3.56	AII and CII*	2.91	.86	3.38
AII and DII*	2.86	.60	4.77	AII and DII*	4.09	.79	5.12
BII and CII*	.50	.59	.85	BII and CII*	.15	.75	.11
BII and DII*	1.15	.57	2.02	BI and DII*	1.32	.68	1.95
CII and DII*	.65	.61	1.07	CII and DII*	1.18	.80	1.46
Series III							
AIII and BIII*	3.49	.60	5.92	AIII and BIII*	2.65	.69	3.83
AIII and CIII*	4.24	.58	7.43	AIII and CIII*	4.84	.71	6.85
AIII and DIII*	4.31	.64	6.73	AIII and DIII*	4.81	.73	6.63
BIII and CIII*	.75	.61	1.25	BIII and CIII*	2.19	.65	3.34
BIII and DIII*	.82	.67	1.22	BIII and DIII*	2.16	.68	3.20
CIII and DIII*	.07	.65	.11	CIII and DIII*	.03	.69	.04
Series I and II							
AI* and AII	.46	.17	2.70	AI* and AII	.63	.43	1.45
BI and BII*	1.75	.26	6.73	BI and BII*	3.00	.34	8.90
CI and CII*	1.59	.30	5.30	CI and CII*	1.31	.50	2.61
DI and DII*	2.56	.25	10.24	DI and DII*	2.48	.12	20.50
Series I and III							
AI* and AIII	1.23	.16	7.69	AI and AIII*	.45	.29	1.57
BI and BIII*	2.76	.31	9.20	BI and BIII*	3.96	.47	8.36
CI and CIII*	2.83	.19	15.00	CI and CIII*	4.31	.44	9.84
DI and DIII*	3.24	.25	12.96	DI and DIII*	4.28	.41	10.36
Series II and III							
AII* and AIII	.77	.09	8.56	AII and AIII*	1.08	.41	2.60
BII and BIII*	1.01	.23	4.39	BII and BIII*	.96	.31	3.16
CII and CIII*	1.26	.14	9.00	CII and CIII*	3.00	.37	8.20
DII and DIII*	.68	.21	3.24	DII and DIII*	1.80	.33	5.54

* Indicates greater mean.

Chase qualified her findings that motivation is generally higher under failure than under success by the statement: "However, these results on Series III may have been influenced by at least two factors: (1) greater interest in the train system than in the water system, or (2) having had a previous success with the same experimenter. Until these two factors have been investigated it is only possible to conclude that if a child has had a previous success with an experimenter and returned one week later to perform a different task in which he might be interested to a greater extent than in the previous one, he will tend to expend a greater amount of energy under failure than he did under success." (Chase, p. 113).

With the above data and descriptive explanation as a background, the present report will be divided into three parts as follows.

Part I. Trends of Effort on Successive Trials by a Re-Analysis of the Data of Chase and of Smith on the 102 Children Available for a Retest.

Part II. Age Performance of 100 Boys Given Success With Praise and Failure With Reproof.

Part III. Failure Versus Success.

TRENDS OF EFFORT ON SUCCESSIVE TRIALS BY A RE-ANALYSIS OF THE DATA OF CHASE AND OF SMITH ON THE 102 CHILDREN AVAILABLE FOR A RETEST

Chase compared the performance of children in the different groups and series by computing mean scores for each child on the last six of the seven trials at each test and then by treating statistically the mean scores for the respective groups. Because such treatment of the data gives no indication of the direction of the curve of effort, she compared the scores on the seventh trial with the scores on the second trial. The stronger motivation ought to show stronger tendencies of the seven successive trials in resisting the downward curve of fatigue.

Chase accordingly determined the percentage of subjects in each motivation group who decreased, remained the same, or increased their scores on the last trial over the second. The first trial was always omitted in the calculations. Chase concluded from her data: (1) A greater percentage of subjects decreased their scores from second to last trial than increased in any six trials given at one time; (2) a greater percentage decreased their scores by 10, 15, or 25 per cent when given control motivation than under success-repetition, success-praise, success-reward, failure-repetition, failure-reproof, or failure-punishment, even though under these latter types of motivation the groups as a whole increased their energy output. "It may also be concluded that these types of motivation not only increase efficiency but tend to more nearly maintain initial efficiency." (Chase, p. 92) This last conclusion holds for the Chase tests but, as will be seen, it does not hold for the retests when the children were three years older nor for the data analyzed to show age differences in performance among 100 boys.

Mean group scores for each successive trial have been computed. These scores are shown in Table 2 which gives also group mean scores for the last six trials.

Although Chase called the first trial in all test series an "adjustment trial" and did not use the scores on this trial in her computations, attention is now called to this first or initial trial. It is not to be presumed that an "adjustment error" could operate in such a way as to make the hand dynamometer record more than the child's ability. Whatever error may be present is operating in one direction: it is adverse to the child. If the mean group scores on the first trial do not represent the true mean ability of the group, the true mean should be somewhat higher than the point where the mean is actually found.

It is not necessary to correct for this possible error in order to see certain tendencies in the performance in Series II that are not due to success. Chase disregarded the scores on the first trial also because success and failure do not operate as motivational forces until after the first trial.

Preceding the first trial in control motivation, each child was asked to squeeze as hard as he could. In Series II, success groups, and Series III, failure groups, he was told either that if he squeezed hard enough something would happen or that if he did not squeeze hard enough something else would happen.

The chief difference in motivation for the first trials in Series I and in Series II seems to be that in Series I the child was given no definite goal while in Series II he was led to believe that he had a chance to ring a bell.

Figures 1 and 2 show graphically the mean group scores per trial contained in Table 2. Figure 1 shows the mean performance per trial for the original Chase tests of 102 children who were grouped into four motivation groups.

TABLE 2

Mean Group Scores in Kilograms per Trial for 102 Selected Chase Subjects and Smith Retest Subjects in Respective Groups and Series*

Series	Trial							Mean Scores**
	1	2	3	4	5	6	7	
Chase Subjects								
Group A								
I	9.13	8.31	7.60	7.30	7.23	6.61	6.77	7.32
II	8.42	7.59	7.20	6.86	6.93	6.49	6.59	6.86
III	7.99	7.51	7.03	6.98	6.91	6.69	6.55	6.09
Group B								
I	8.61	7.78	7.33	6.72	6.57	6.27	6.23	6.82
II	9.78	9.11	8.84	8.59	8.31	8.40	8.33	8.57
III	10.09	10.15	9.90	9.53	9.48	9.03	9.08	9.58
Group C								
I	9.51	8.27	7.71	7.50	7.02	7.36	6.88	7.48
II	9.89	9.50	9.33	9.03	8.98	8.84	8.74	9.07
III	10.98	10.85	10.79	10.68	10.27	10.21	10.10	10.33
Group D								
I	8.88	8.05	7.29	6.67	6.62	7.03	6.72	7.16
II	9.99	9.82	9.95	9.69	9.60	9.47	9.32	9.72
III	11.31	10.48	10.44	10.57	10.48	10.23	10.34	10.40
Smith Retest Subjects								
Group A								
I	13.18	12.82	12.08	11.92	11.64	11.66	11.25	11.90
II	12.95	11.65	11.32	11.69	10.99	11.26	10.98	11.27
III	14.45	13.71	12.70	12.31	12.46	12.11	12.05	12.35
Group B								
I	13.09	11.81	11.51	11.08	11.08	10.79	10.72	11.04
II	15.05	14.81	14.64	14.32	13.79	13.60	13.42	14.04
III	18.32	16.56	15.51	14.84	14.58	14.54	13.63	15.00
Group C								
I	14.33	13.55	13.03	12.91	12.62	12.45	12.22	12.88
II	15.89	15.23	13.69	14.00	13.89	14.00	13.74	14.19
III	19.57	18.60	17.23	17.20	16.84	15.16	15.60	17.19
Group D								
I	15.16	14.23	12.94	12.97	12.65	12.44	12.12	12.88
II	16.79	16.09	15.59	15.51	15.26	15.11	14.82	15.36
III	20.61	19.15	18.25	17.34	16.63	16.29	15.35	17.16

* Mean scores for last six trials.

* From Anderson and Smith, Table 2, p. 143.

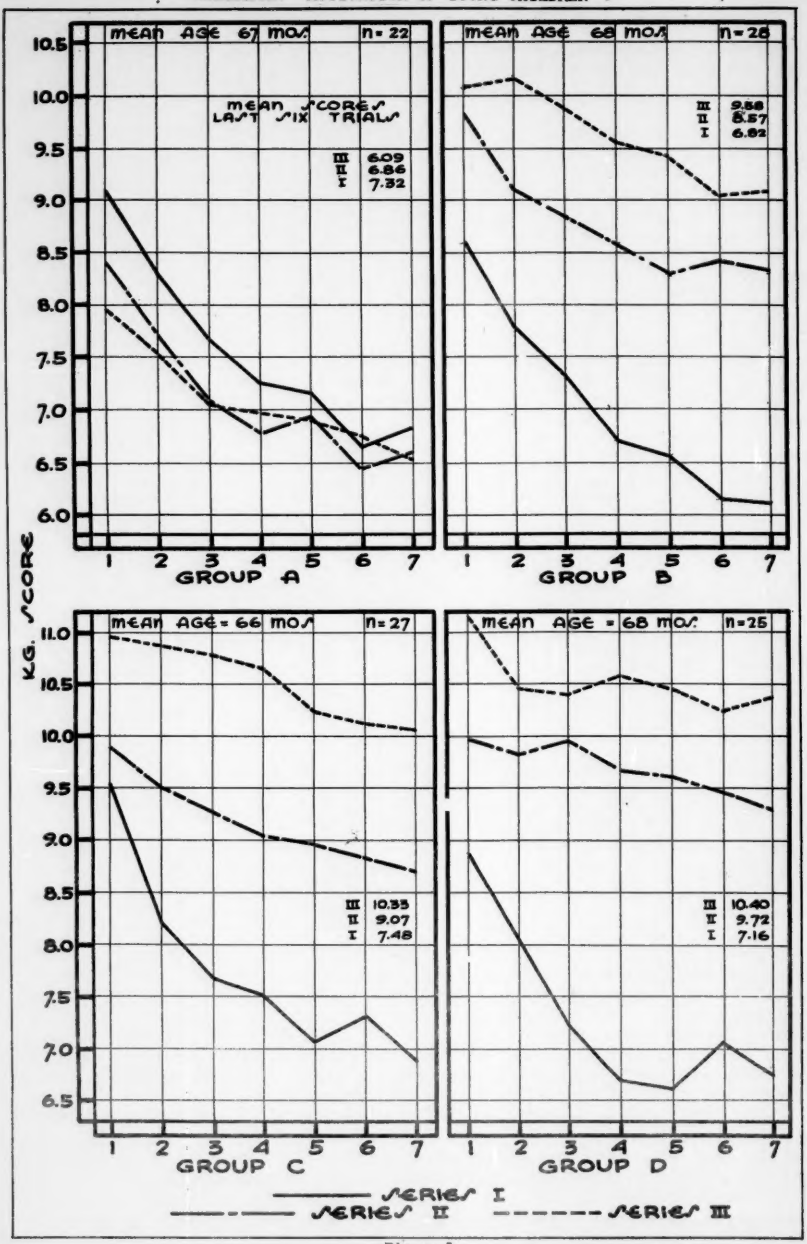


Figure 1
Graphs of Mean Trial Scores for Each of the Seven Trials for All Subjects by Series in Groups A, B, C, D for the 102 Selected Chase Subjects.

Series I is control motivation for all groups - A, B, C, and D. The mean initial effort in all groups falls within a range of less than one kilogram. The means computed from the last six trials of groups B, C, and D lie within the range of .66 kilograms. Moreover, the tendencies of the curves are similar. The conclusion seems to be properly drawn by Chase that control motivation (Series I) in all four groups was practically the same.

In Group A, which received control motivation on all three series, the tendencies of the curves are likewise similar. The initial trials decrease from week to week. The seventh trials of all three curves lie within the negligible range of .22 kilograms. In spite of this, there are significant differences in mean group scores for the last six trials as between Series I and III and between Series II and III, the performance in Series III being lower in both comparisons. Practice effects, if any, are affecting performance adversely.

In Group B, however, the tendencies are different. This group of children experienced both success and failure with repetition of instructions after each trial. The curve for success and failure each show greater resistance against fatigue than does the curve for no knowledge of results. The mean group scores for the last six trials show significant differences in all three comparisons between series. That is, according to the Chase method of analysis, failure is a significantly greater motivation than success, and both failure and success are greater than the control motivation.

When the children came back the second week and were given a chance, as they thought, through their own efforts to ring the bell, they showed a mean score on the first trial considerably higher than they did the preceding week when they had no possibility of knowing what they were achieving.

Since there were no practice effects operating to increase the initial score of Series II in Group A, one variable which can account for the greater initial effort is the introduction of a definite goal for the child. This higher initial score is seen in all cases in this experiment where a definite goal has been offered the child.

The drop in mean scores after success in the first trial is not as steep as in control motivation, and the success curve tends to flatten out horizontally at the end.

The third week the children came back and experienced failure after a still slightly higher initial trial. But the first three trials exceed any of the mean trial scores for success, and the remaining trials show a tendency for failure to parallel success although at a higher performance level.

Inspection of the curves for Groups C and D show similar tendencies. In these two groups the comparisons of mean group scores for the last six trials show significant differences except as between D-II and D-III. In Group D it is impossible to account for the fact that twenty-five children show after the first taste of failure a mean drop greatly in excess of the range of the mean scores of the next six trials. Having rung the bell seven times and received seven gold stars only one week previously, were their expectations too high? Was it a discouraging shock the first time to see the experimenter actually cut out of the paper "ginger-bread boy" one of the pretty red buttons? Chase observed that some of the children failed to take the punishment seriously, some even laughing over it. She feels, herself, that the punishment was not effective and that it may have somewhat distorted the operation of the other motivational factors.

The graphs in Figure 1 seem consistent with the general findings of Chase with perhaps two exceptions related to Groups B, C, and D.

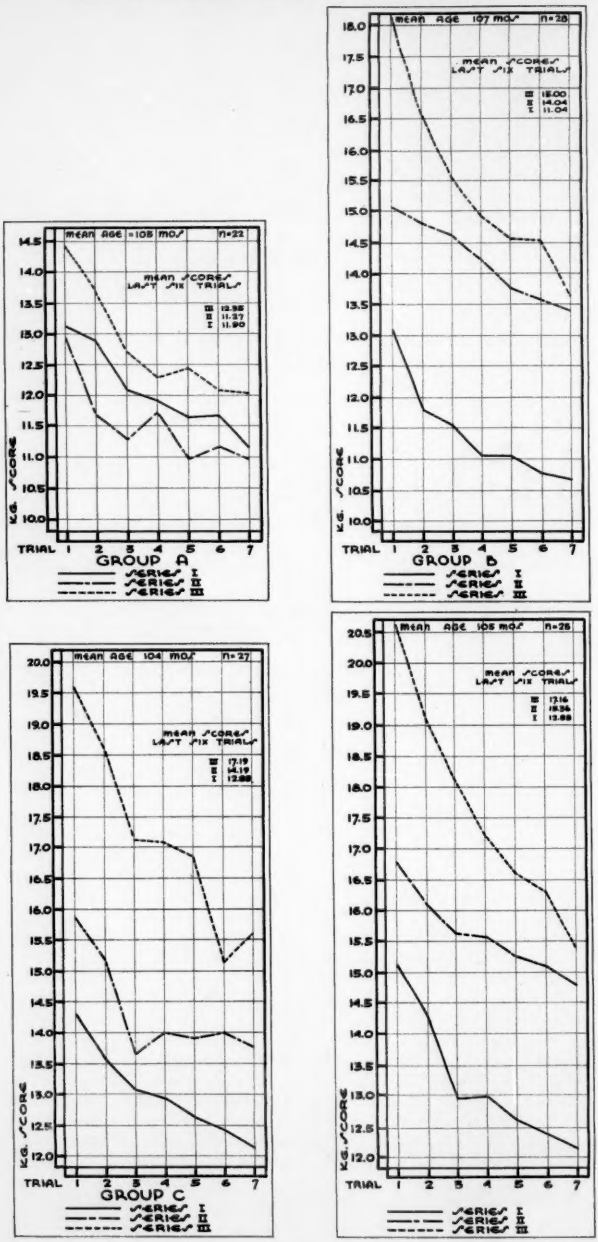


Figure 2
Graphs of Mean Trial Scores for Each of the Seven Trials for All Subjects by Series in Groups A, B, C, D, for the 102 Smith Re-test Subjects.

1. The possibility of a definite goal to strive for in Series II accounts for the fact that initial trials in Series II are in all cases higher than initial trials with an unknown goal (Series I). Only after the first trial in Series II does the factor of success begin to operate with the accompanying factors of repetition of instructions, praise, and reward in the respective groups.

2. The superiority of Series III over Series II should be explained not as due to the finding that failure was a stronger motivation than success, but as due to a complex set of forces of which failure is only one. The initial trial of Series III for Groups B, C, and D was superior to anything achieved under success motivation; yet in each case it was performed before the child became aware of failure. This superior performance cannot therefore be explained by failure.

Chase has suggested the reason, borne out by the observations of Anderson and Smith, that the "train system" for informing the child of failure was more interesting to the children than was the "water system" for giving visual knowledge of success.

Another factor is probably the fact of success one week previously including the various social implications of success in the presence of the two adults, the experimenter, and the recorder. It is not to be presumed that in the first trial of Series III it has meant nothing to the child to have rung the bell seven consecutive times only a week before.

An inference not contradicted by any findings and supported by the data is that both success and failure plus greater interest in the water system plus more familiarity with the apparatus and the experimenter plus a greater spontaneity arising out of all these factors contributed to making the mean group scores of Series III significantly greater than those of Series II, except in Group D when reward and punishment were used and the difference approached significance.

The retests of these 102 children although showing general tendencies similar to those reported by Chase, do not show quite the same tendencies when the mean group scores are computed for each successive trial. See Figure 2.

In Series I, control motivation, the curves for all four groups, A, B, C, and D, not only begin within a fairly comparable range but as in the Chase data show similar tendencies through the seven trials.

In Group A none of the mean group differences are significant, although something operated to make the scores the third week reverse the position in the Chase data and exceed the scores for both Series I and Series II. With one exception the probable errors of the differences in all the retest data are higher than in the data obtained by Chase.

Group B had success and failure accompanied by a repetition of instructions. Success and failure are each significantly greater than no goal motivation in Series I. But failure is not significantly greater here than success, although the mean trial scores for failure are each higher than the mean corresponding scores for success. The pitch of the two curves if extrapolated to one more trial would show failure actually dropping below the success curve. The lack of significant difference between success and failure plus the steep drop of the failure curve cannot support a conclusion that failure with repetition of instruction is greater motivation than success with repetition of instructions. These facts would lead rather to the conclusion that the "greater interest in the train system" was disappearing fast.

The inference is that some other factors operated to produce a higher initial performance the third week and that failure operated even less than success to sustain initial effort against a waning interest and fatigue.

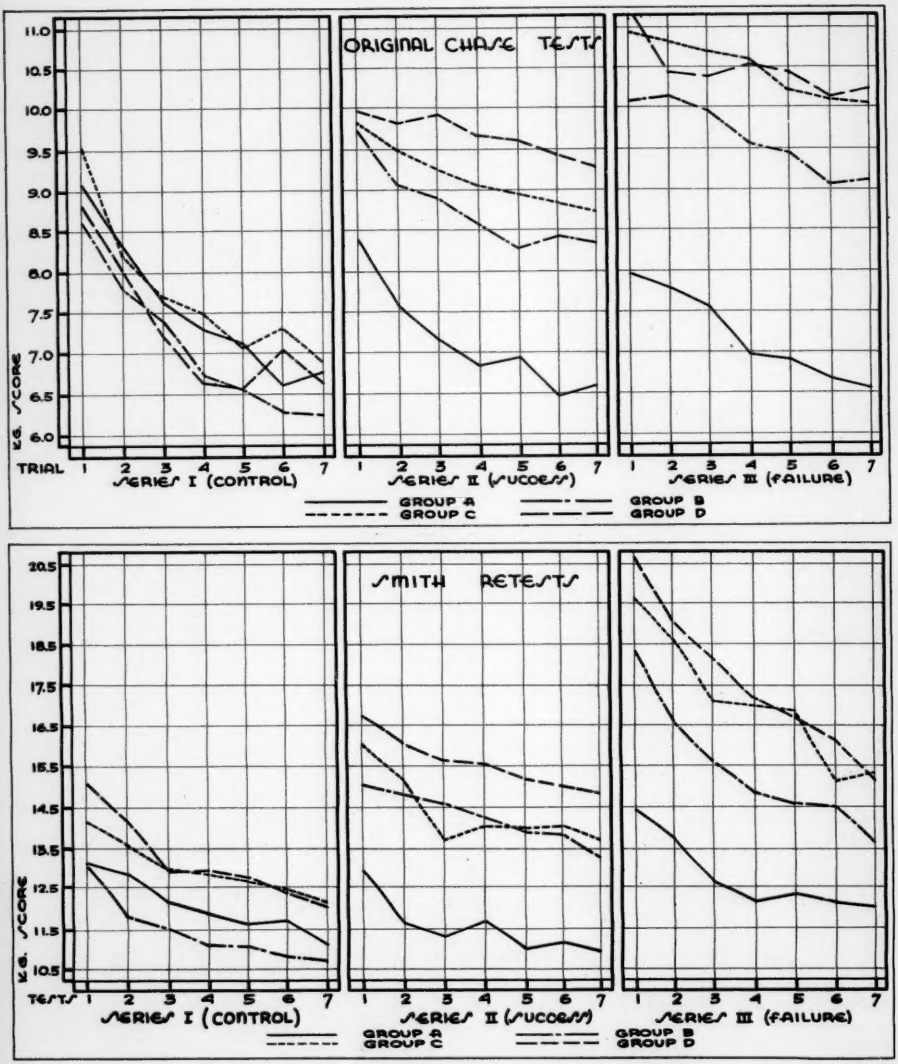


Figure 3
Graphs of Mean Trial Scores for Each of the Seven Trials for 102 Subjects by Series in Motivation Groups A, B, C, D showing Original Chase Tests and Smith Retests.

Group C received praise with success and reproof with failure. The initial trial in Series II is sufficiently greater to add confirming evidence that a definite goal is better motivation than an indefinite goal. The evidence is against the possibility that on this trial the factors of practice and familiarity may also be operating. It has been seen that Groups A in both Chase and Smith data show that the first trial one week after control motivation produced in both the original test and the retest mean scores lower than the initial trial score the first week. In Series III of Group C the initial trial is again far above any other score. Failure as a psychological factor does not begin to operate until after the first trial. Although significantly greater than success in mean group score comparisons, after the first taste of failure the performance drops at a much swifter pace than the rate of drop for success.

In Group D all mean group score differences between series are significant, the difference between success and control motivation being over twenty times its probable error. The same tendencies as found in Groups B and C can be seen in the directions of the curves.

It might be mentioned as a further explanation of the steep drop of the failure curves in Groups B, C, and D that with so much greater effort on the initial or early trials it is to be expected that fatigue will appear more quickly. The tendencies of the different curves beyond the seventh trial are unknown. Some children reported sore hands after the seventh trial, for which reason it is not clear that extrapolation beyond the seventh trial is justified.

Figure 3 shows the curves of mean trial scores for Chase and Smith tests assembled so as to compare groups on each series. The curves for both the original Chase tests and the Smith retests are plotted from performances by the same children retested after an interval of three years. Control motivation is more uniform in the younger ages as tested by Chase than in the same children when tested by Smith. It is not probable that differences in experimenters or in test situations account for the different tendencies shown between the Chase and Smith data. The precautions which were taken to make the retest uniformly like the original test have been discussed elsewhere by Anderson and Smith.

AGE PERFORMANCE OF 100 BOYS GIVEN SUCCESS WITH PRAISE AND FAILURE WITH REPROOF

Of the twenty-seven boys in the original Chase Motivation Group C, eighteen were available three years later for retest by Smith. Since the retest showed general mean tendencies similar to those reported by Chase, it was felt that these retest boys could be counted as new subjects. To this number of forty-five it was hoped to add a sufficient number of new boys to make four age groups of twenty-five each. One hundred cases were obtained[4], but due to absences and other difficulties in getting children for three consecutive weekly tests the age distribution appeared as given in Table 3. Age is calculated to the nearest birthday.

Table 3 gives for the respective series the mean scores[5] and probable errors of the mean and standard deviations for age groups and for the entire group of 100 boys.

Figure 4 shows graphically the mean scores presented in Table 3. It can be seen not only that the age groups increase their performance as the boys grow older, irrespective of the motivation offered, but also that this increase is

[4] The writer was assisted in this study and in study discussed in Part III of this report by Ruth S. Smith, a graduate student who gave the tests, and by Harold S. Carlson, Research Assistant at the Iowa Child Welfare Research Station, who served as recorder.

[5] The term scores is taken to be based on trials two to seven inclusive unless indicated in the text that it is a mean of group performance on one trial.

proceeding at an increasing rate.

TABLE 3

Mean Scores in Kilograms for Trials Two to Seven Inclusive, Standard Deviations, and Probable Errors by Age Groups and Series for 100 Boys in Motivation Group C

Age, Years	Number	Series I			Series II			Series III		
		Mean	Standard Deviation	Probable Error of Mean	Mean	Standard Deviation	Probable Error of Mean	Mean	Standard Deviation	Probable Error of Mean
5	13	7.2	1.24	.23	9.2	1.96	.37	10.2	1.17	.22
6	28	8.2	2.10	.27	9.9	2.78	.35	11.0	3.11	.40
7	20	9.3	1.87	.28	11.9	2.50	.38	13.2	3.17	.48
8	16	10.8	2.77	.47	12.9	3.00	.51	14.8	2.93	.49
9	13	14.2	3.41	.64	17.0	3.30	.62	18.6	4.44	.83
10	4	12.3	1.46	.49	14.4	1.50	.51	16.2	1.17	.39
11	6	13.1	1.76	.48	16.8	3.45	.95	16.6	4.66	1.28
Total Group	100	9.9	3.2	.22	12.2	3.8	.26	13.5	4.2	.28

These data now add confirming evidence to tendencies seen in comparing Figures 1 and 2 in Part I of this article. In the retest of 102 children after an interval of three years, not only did they show higher kilogram differences in performance but they showed greater variability. There is evidence that performance on a hand dynamometer correlates with weight. Kilogram units of measurement are not fixed units having the same meaning at each age. A kilogram variation at age five is more of a variation than a kilogram at age nine. The use of percentage increases and decreases by Chase and by Anderson and Smith has acted as a correction for this elastic tendency in the measuring stick. In making mean group score comparisons between different kinds of motivation, it is necessary that the factors related to the increasing rate in older boys be kept comparable in the groups.

In computing the probable errors of the difference between mean scores, the following formula for correlated measures was taken from Holzinger.[6]

$$P.E._{M_1M_2} = \sqrt{(P.E._{M_1})^2 + (P.E._{M_2})^2 - 2r_{12}P.E._{M_1}P.E._{M_2}}$$

In order to use this formula, correlations were obtained and are given here in Table 4 even though the numbers are small.

TABLE 4

Correlations* Between Series by Age Groups for 100 Boys in Motivation Group C

Age, Years	Number	Series I and II		Series II and III		Series I and III	
		r	P.E.r	r	P.E.r	r	P.E.r
5	13	.75	.09	.78	.08	.62	.12
6	28	.75	.06	.78	.05	.79	.05
7	20	.81	.05	.61	.10	.55	.11
8	16	.87	.04	.78	.07	.59	.12
9	13	.86	.05	.78	.08	.91	.03
10	4	-.42	.29	-.62	.22	-.42	.29
11	6	.15	.28	.95	.03	.09	.28
Total Group**	100	.86	.03	.83	.04	.79	.04

*rs for age groups computed by the rank Difference Formula

**rs for entire group computed by the Seashore Formula.

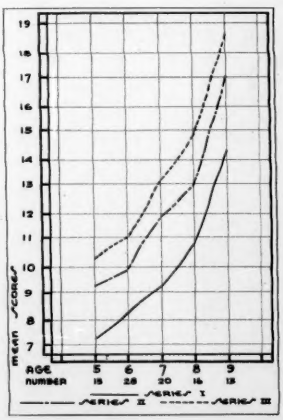


Figure 4.
Graphic Representation of the Mean Scores (of Trials 2 to 7 inclusive) for Age Groups in Each Series for Boys in Motivation Group C.

[6] Holzinger, Karl J.: Statistical Methods for Students in Education. New York: Ginn, (c. 1928) Pp. viii; 372. (p. 243)

The two oldest age groups should be disregarded on account of insufficient cases. Correlations for the other age groups, though less than those found in the Chase study, do not compare unfavorably with those obtained from the Smith retest data. When correlations are computed for the entire group, they are still somewhat under those for the Chase data but are superior to those from the retests. These comparisons are mentioned because in the two preceding studies the correlations were used as one of the methods for establishing reliability of the tests.

Table 5 gives for age groups and for the entire group the comparisons of mean scores by series showing the obtained differences, the probable errors of the differences, and the critical ratios.

TABLE 5

Differences, Probable Errors, and Critical Ratios Between Mean Scores for Series by Age Groups for 100 Boys in Motivation Group C

Age, Years	Number	Series I and II			Series II and III			Series II and III		
		Difference	Probable Error of Difference*	Critical Ratio	Difference	Probable Error of Difference*	Critical Ratio	Difference	Probable Error of Difference*	Critical Ratio
5	13	2.0	.25	8.0	1.0	.24	4.1	3.0	.20	15.0
6	28	1.7	.23	7.4	1.1	.25	4.4	2.8	.25	11.2
7	20	2.6	.23	11.2	1.3	.39	3.3	3.9	.40	9.7
8	16	2.1	.25	8.4	1.9	.33	5.7	4.0	.44	9.0
9	13	2.8	.33	8.5	1.6	.52	3.0	4.4	.42	10.5
10	4	2.1	.54	3.8	1.8	.41	4.4	3.9	.48	8.0
11	6	3.7	1.00	3.7	.2**	.48	.4	3.5	1.14	3.0
Total Group	100	2.3	.13	18.0	1.28	.16	8.0	3.58	.18	20.0

* Formula for correlated measures.

** In all cases means for Series II are greater than means for Series I; III is greater than II, with this one exception, and III is greater than I.

In the five youngest age groups comprising ages 5, 6, 7, 8, and 9, the differences between mean scores are not only consistently in the same direction, but, with two exceptions, and in spite of small numbers, the differences are significant. The two exceptions approach significance.

Chase stated that "because of the limited number of cases in each test group it is not possible to draw any conclusions as to the relationship between either age or sex and motivation as given in this study." (Chase, p. 102) She did find, however, "a tendency for a greater percentage of younger subjects to increase their scores in Series II and III over Series I than for older subjects."(p. 99) By way of explanation Chase adds: "Just what factors are operating to inhibit the initial performance of the younger children is not clear. It may be that the younger child needs more motivation in comparison with the older child for effective performance than that given in the control-motivation series. A more probable factor is that physiological age or conditions are in some way accounting for the lower performance on this initial test. An older child may be able to adjust his hand and arm muscles to the apparatus much more effectively than the younger child because of better coördination and thus better symmetry of action." (Chase, p. 99)

The data obtained from these 100 boys were further analyzed to yield mean trial scores for the respective age groups and for the entire group. These mean trial scores have been plotted graphically and are given in Figure 5. Graphs are omitted for the two highest age groups, which together have only ten children. It might be pointed out again that all the differences between mean group scores for the second to the seventh trials inclusive were significant.

For the group taken as a whole, the critical ratios of these differences are in round numbers 8, 18, and 20 for the three comparisons.

In the graphs in Figure 5 can be seen the same tendencies pointed out in Part I of this report comparing 102 children with their own scores three years later.

Control motivation curves for mean trial scores in Series I seem to hold to essentially the same form and to extend through approximately the same range irrespective of age.

Success curves tend more to sustain effort through the successive trials, though the tendency in absolute scores is slightly less in the older boys. In the two youngest groups, failure curves tend to parallel success curves, but as age increases the failure curves tend to fall more than do the success curves.

When the mean trial scores of the entire group of 100 boys are plotted, failure appears not to sustain effort as much as does success. Translating these tendencies into percentage of decrease, comparisions between second and seventh trials do not equate the tendencies. Success motivation scores on the seventh trial decrease approximately 8 per cent, while failure scores decrease 13 per cent.

At all ages the mean scores for initial trials at each successive week show marked increases in effort. This adds supporting evidence to the assumptions (1) that a definite goal is stronger motivation than an indefinite goal and (2) that some factors besides failure are strongly operating in Series III, though they tend to weaken with successive trials.

FAILURE VERSUS SUCCESS

Chase felt that some factors other than failure might be accounting in part for the significantly higher mean failure scores of subjects who received success the second week and failure the third week. She suggested that the train system appeared to be more interesting to the children than the water system and that the fact of success one week previously might be contributing to the failure motivation.

An attempt was made to study the second of these factors by holding constant all procedures in Group C motivation except the order of success and failure. This order was reversed.

Forty-four children were given the regular control motivation the first week, failure with reproof on the water system the second week, and success with praise on the train system the third week.[7]

TABLE 6

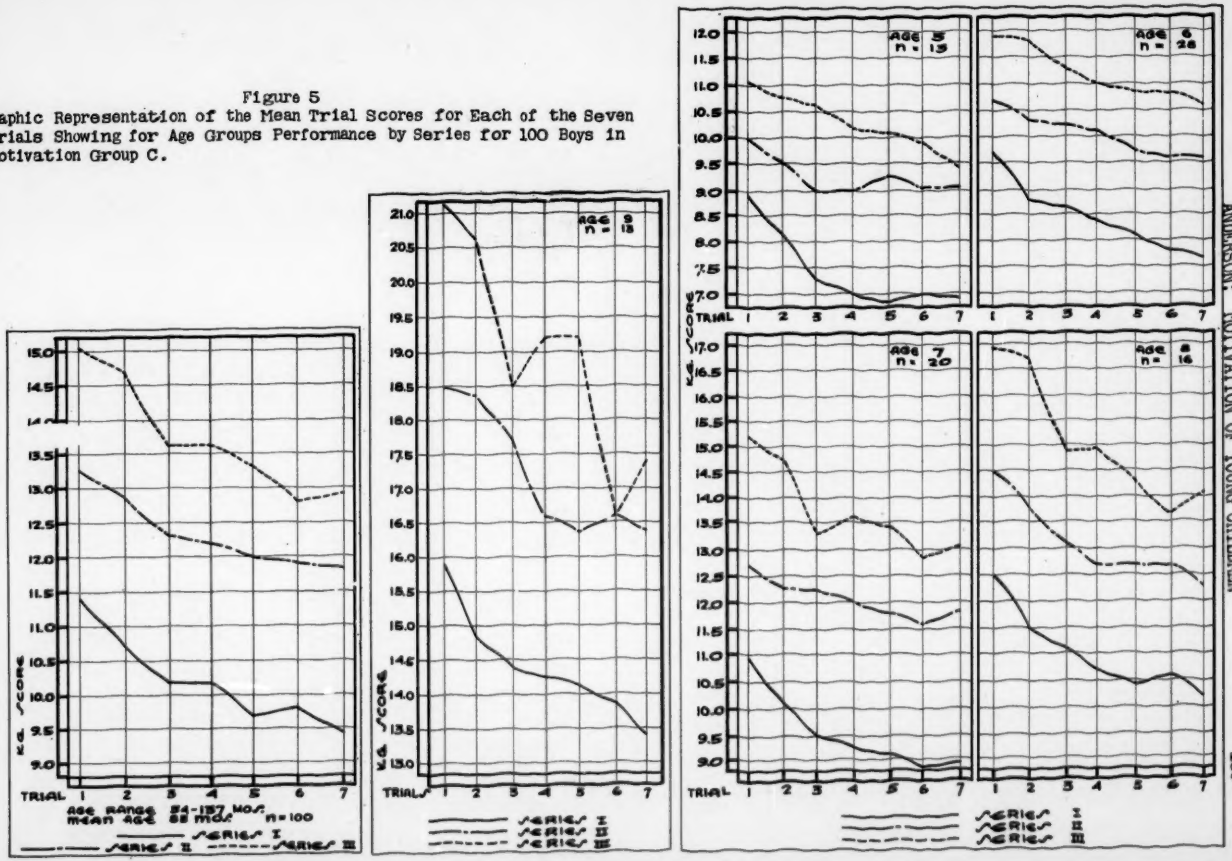
Analysis of Group E Subjects in Terms of Age, Months*

Sex	Children	Age, Years			Mean Age, Months	Age Range, Months
		3	4	5 and 6		
Boys	18	6	8	4	46.1	31 to 66
Girls	26	7	6	13	54.4	32 to 75
Boys and Girls	44	13	14	17	51.0	31 to 75

* Age is calculated to the nearest birthday; e.g., age four includes children between three years, six months and four years, five months.

[7] This procedure and this group of tests will be referred to as Motivation Group E.

Figure 5
Graphic Representation of the Mean Trial Scores for Each of the Seven Trials Showing for Age Groups Performance by Series for 100 Boys in Motivation Group C.



The age and sex distribution together with mean ages and age range in months is given in Table 6. There were eight more girls than boys, and the mean age and upper limit of the age range was somewhat greater for girls than for boys.

Table 7 gives by series the mean scores in kilograms, the probable errors of the mean, and the standard deviations and probable errors of the standard deviations for the forty-four subjects.

TABLE 7

Mean and Standard Deviation of Scores in Kilograms for Trials 2 to 7 by Series for the Forty-Four Group E Subjects

Series	Sub-jects	Mean	Probable Error of Mean	Stand-ard De-viation	Probable Error of Standard Deviation
E_1	44	4.28	.17	1.65	.12
E_2	44	4.89	.12	1.20	.09
E_3	44	6.60	.20	1.99	.14

In order to compare the differences between the mean scores by series, the same formula for probable error of the difference for correlated measures as given on page 136 was used. The correlations together with the probable errors of the correlations between the series were as follows:

Series (N = 44)	r	$P.E._r$
I and II	.74	.05
II and III	.71	.05
I and III	.50	.07

Table 8 compares performance between the series showing differences, probable errors of the differences, and critical ratios for differences between the mean scores and the standard deviations. The critical ratios for mean differences between the series are decisive. Failure-reproof motivation is still significantly different from control-motivation. Likewise success-praise motivation, as given in this study, continues to be a significantly greater motivation than control-motivation. When, however, the order of success-praise, followed a week later by failure-reproof motivation, is reversed, failure-reproof is no longer significantly superior to success-praise as found by Chase and as confirmed on retests by Anderson and Smith. On the contrary, success-praise when given one week after failure-reproof is significantly superior to failure-reproof. The critical ratio is 11.96 which is slightly above the critical ratio of 8.85 in the reverse order reported by Chase.

TABLE 8

Reliability of Differences of Means and Standard Deviations Between Series for the Forty-Four Group E Subjects.

Series	Mean			Standard Deviation		
	Mean Differ-ence	Probable Error of Differ-ence	Critical Ratio	Standard Deviation of Dif-ference	Probable Error of Differ-ence	Critical Ratio
I and II*	.61	.115	5.30	.45	.08	5.6
II and III*	1.71	.143	11.96	-.79	.10	7.9
I and III*	2.32	.187	12.40	-.34	.13	2.6

* Indicates the series with the greater mean score.

This leaves unmistakably the conclusion that factors other than failure were affecting performance on Series III in the Chase Motivation Group C procedure. These findings do not justfy the assumption, however, that it is the same factors which have been responsible for the reversal in superiority in Motivation Group E procedure. It is still possible that the train system holds more interest for the child and affects his performance accordingly, but it is probable that the change in procedure which converted Motivation Group C into Motivation Group E has entirely changed the situation in which the child is placed and that the reversal of the position of superior motivation is due in considerable part to the differences in the situations.

Two procedures have been followed for studying the effect of the procedure in Motivation Group E on the tendency to maintain the initial performance in the succeeding trials. One was to determine the percentages of children who decreased the scores 25 per cent or more on the last trial over the second trial, who decreased less than 25 per cent on the last trial over the second trial, and who remained the same or increased on the last trial over the second trial. The numbers and percentages of children are given in Table 9.

TABLE 9

Percentages of Children Who Decreased Their Scores 25 Per Cent or More on the Last Trial Over Trial 2, Who Decreased Less Than 25 Per Cent on the Last Trial Over Trial 2, and Who Remained the Same or Increased on Last Trial Over 2, for Motivation Group E

Series	Decreased 25 Per Cent or More		Decreased Less Than 25 Per Cent		Scores Remained Same or Increased	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
E_1	2	4.5	31	70.5	11	25.0
E_2	2	4.5	23	52.3	19	43.2
E_3	0	0.0	34	77.3	10	22.7

This table may be compared with data reported by Chase (p. 87) for her Motivation Group C having fifty-three subjects. She found that from two-thirds to slightly over three-fourths of her subjects decreased their scores, whereas from 18 to 30 per cent increased them. The percentages of the Chase Group C whose scores remained the same on the three series was very small.

The Chase group shows a small though steady decline in the number of children whose scores decreased, the percentages from Series I, II, and III being respectively in round numbers 77, 75, and 68. In Group E the percentages of children decreasing in the same serial order are in round numbers 75, 57, and 77. The percentages given in Table 9, to the extent that they can indicate tendencies to maintain efficiency of effort on the initial trial, would lead to the inference that failure operates more strongly than success in maintaining such efficiency in Group E. The Chase data for Group C also indicate a superior tendency for failure to maintain the efficiency of the initial trial.

The other method for studying the effect of motivation on maintaining efficiency was to calculate mean group trial scores for the successive trials. These mean trial scores are given in Table 10 and are reproduced graphically in Figure 6.

The curve of mean trial performance on control-motivation in Series I is different in pattern and range from any other motivation curve obtained from a control group. The curves for failure and for success are also more regular and more horizontal than any other such curves plotted for this report.

TABLE 10

Mean Group Trial Scores in Kilograms for Group E

Series	Trial						
	1	2	3	4	5	6	7
I	4.47	4.38	4.68	4.37	4.18	4.22	4.14
II	5.04	4.97	4.89	4.83	4.87	4.90	4.95
III	6.78	6.78	6.72	6.57	6.50	6.51	6.50

The horizontal tendencies of both success and failure curves may be explained in part by the ages of the children in Group E. It was seen in Figure 5 that the younger children tend to show both success and failure curves that are more horizontal in kilogram units than the success and failure curves for older boys.

Figure 6 shows also that according to the mean initial trial in Series II a definite goal seems to evoke more effort than no goal. The initial trial in Series III, like the initial trial in those other motivation groups in Series III which have a definite goal, is relatively much higher than any other score previously made; this in spite of the fact that forty-four children had each failed to ring the bell on seven successive trials only one week previously. This would seem to be unmistakable evidence that in these data for Motivation Group E some factors other than success and praise are operating to influence achievement in Series III. Perhaps the reason for this lies after all in the greater interest which the children showed in the train system. This is the next factor to be investigated.

SUMMARY AND CONCLUSIONS

This report gives further light on the study of motivation of young children begun by Chase with a hand-dynamometer as the chief measuring tool. While a retest of 102 of the children after an interval of three years showed comparable group tendencies (Anderson and Smith), this report adds the following conclusions to those previously found.

Trends of Effort on Successive Trials by a Re-Analysis of the Data of Chase and of Smith on the 102 Children Available for a Retest.

A re-analysis of the scores giving group mean scores for each trial on the original Chase data and the Smith retest data for 102 children in the four motivation groups showed the following facts:

1. Irrespective of success or failure, a definite goal with the possibility of knowing the results of one's efforts evoked more effort than an indefinite goal which did not offer knowledge of results.

2. Other factors besides failure are known to be affecting the performance of children in the failure series. In Series III the mean scores on initial trials in Groups B, C, and D are in all cases higher than the mean scores of any other trial in any group or series in the original test or the retest data. These highest performances occurred in the failure series immediately before failure was introduced.

3. Contrary to Chase's findings, which were confirmed from her own data by these analyses, the retests of the children showed that failure motivation did not "tend to more nearly maintain initial efficiency" when compared with control motivation. In fact, the initial efficiency was maintained much better by success, while the performance under failure conditions showed a precipitate drop such as would be expected under either a swift onset of fatigue or a quickly waning interest.

Age Performance of 100 Boys Given Success With Praise and Failure With Reproof.

A study of the performance of 100 boys divided into age groups in Motivation Group C where they were given successively control motivation, success with praise, and failure with reproof warrants the following conclusions:

1. As age increases, boys tend in all three types of motivation situations to expend effort at an increasing rate.

2. As age increases, the motivation in Series III seems to be less effective in maintaining initial effort during the seven trials.

3. In control motivation age seems to have little effect on the tendency to maintain initial effort.

4. The data on the entire group lend evidence to support the conclusions (1) that a definite goal is a stronger motivation than an indefinite goal and (2) that some factor or factors besides failure are affecting the performance in Series III.

Failure Versus Success

The procedure of the Chase Motivation Group C was repeated on forty-four new subjects with the exception that the order of success with praise followed by failure with reproof was reversed. This motivation procedure is referred to as Motivation Group E. The following conclusions are supported by the data:

1. The findings of Chase for Group C are now reversed. In Group E success-praise is a significantly greater motivation than failure-reproof. That is, whether success precedes failure or failure precedes success in these two groups, the performance of the children on the third week is significantly greater than the performance on either the first or second weeks.

2. Either success or failure whether preceded or followed by the other is significantly greater than the control motivation.

3. There is evidence that some factor or factors other than success-praise are considerably affecting the performance of the children on Series III of Group E.

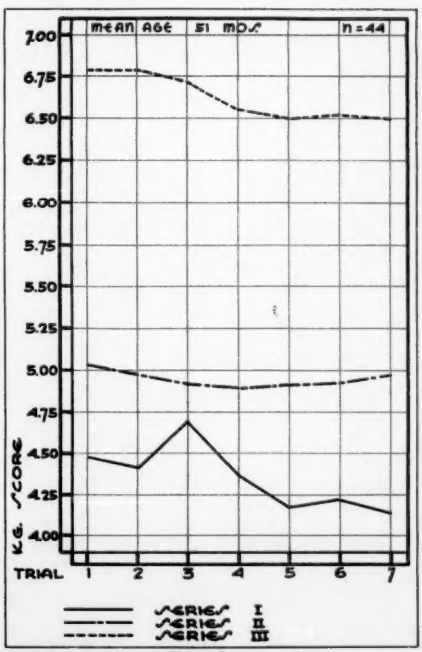


Figure 6.
Mean Trial Scores in Kilograms for Each of the Seven Trials by Series for the Forty-four Group E Subjects.

THE DEVELOPMENT OF CONCEPTS
A STUDY OF CHILDREN'S DRAWINGS

SINA M. MOTT [1]

It is the purpose of this study to present a summary of an investigation concerning the relationship between the formation of concepts and the child's overt behavior.

HISTORICAL SURVEY

The Atomists (16) in 420 B.C. led by Leucippus and his disciple Democritus, held - by theory - that all material for the development of concepts passed through the channel of the senses. The concepts, themselves, were not the reality but they were the impressions of the reality coming to the individual by means of the sensations. According to Plato, however, the material for the building of the concepts might come from either the senses or from reason; in fact he held more valuable those which came by the messenger of the gods - reason. By 1690 we find John Locke (9) denying the existence of innate ideas and introducing his "clean sheet" concept of the mind.

The laws governing the mental organization of this material were formulated by Aristotle in his monumental work of the Oranon. These laws which were later termed laws of association were attacked by William Wundt (17) of Germany and William James (6) of United States. The theory that they become associated by means of the S-R bonds (15) is now being shown refutted by the work of Lashley (8) and Dunlap (4). While the work of Pavlov (12) throws much light on the more simple mental processes the work of Lashley shows that the complexity of the function of the brain is greater than this simple theory permits. The recent experiments of Coghill (3), Carmichael (2), and Kofka (7) substantiate the idea that development progresses from the whole to the part - from a vague impression of the undifferentiated total to the emergence of discrete elements. The question then arises what is the relationship between these developing concepts and the overt expression. To determine this we turn to a study of the relationship of an idea portrayed in the child's drawing and the overt expression of this same idea.

It has been found by such workers as Ricci (13), Passy (11), Barnes (1),Lukens (10) and Sully (14) that drawings made by children between the ages of about four and eight years are "knowledge" drawings. That is they are a description of the object according as the impression of it is more or less clear in the child's mind. Drawings made by the children of this period then make excellent material for the study of the development of concepts.

THE METHOD

The method used in this investigation partook of the nature of the latitudinal in that it was a study of the drawings of 138 children - 562 drawings. Not only were the drawings made by these children studied but also the results of: 1) three mental tests - Pintner-Cunningham Primary Mental Test, The Porteus Maze and the Goodenough Scale for Measurement of Intelligence by Drawing - 2) Two personality tests - Marston's "Personality Rating Scale" and Rogers' "A Test for Personality Adjustment" - 3) three muscle coordination tests by Franz and 4) two drawing tests - Thorndike Scale for General Merit of Children's Drawings and the Kline-Carey Measuring Scale for Freehand Drawing. But this investigation differed from the usual latitudinal method in that the drawings were considered in relationship to the child who drew them. The first 101 made three drawings apiece and the last thirty-seven drew seven. On the sheet on which the child made his drawing were recorded the name of the child, the time taken to draw the picture together with the name of the person and the object drawn. Thus this investigation partook of the nature of the intensive study in that it was interested in

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the drawings of the individual child in relationship to his personality and it was extensive in that it covered a sufficient number to warrant the use of the statistical methods.

THE ORDER FOR COLLECTING THE MATERIAL

The material was collected in the order of: 1) call for the picture,

> To-day we are going to draw a picture of a person. It may be any person that you choose. Draw the very best one that you can. Take all the time that you wish. When you are done raise your hand that we may know that you are through and may take up the paper.

As each completed his drawing, the amount of time required to make the picture and the name of the person drawn were recorded on the sheet. This was followed by 2) a group test and then 3) the individual tests. The same procedure was followed on the second day, an alteration being the call for a "man" to be drawn. The third day the call was for a "man and something else."

THE ANALYSIS OF THE DRAWINGS

The analysis of the drawings involved: the study of the lines used in drawing the picture, the ratio of the length to the width and of the head to the other parts of the body, the insertion of different elements, the time required to make the drawings, the number of different objects added, the activity portrayed, and the portrayal of an awareness of one's environment.

THE SCALE

The five items: the time taken to draw the picture, ratio of the length to the width, the number of additional objects, the portrayal of activity, and the portrayal of an awareness of one's environment became the basis for the construction of a scale. It was found that the first three items fitted readily into five point scales, the sorting technique was employed for the last two items. Each of the three sets of drawings were handed to five different graduate students to sort into five piles: 1) activity portrayed in(A) arms and(B) legs; and 2) awareness of one's environment as to(C) dress and(D) type of activity. The directions given for the sorting of the pictures for activity in the arms were:

> You are asked to consider only the activity portrayed in the arms. After discarding all the pictures in which there are no arms drawn, sort the remaining ones into five piles - No. 1 no activity portrayed ..... No. 5 the portrayal of the greatest amount of activity. Make as many alterations as you wish until you are satisfied with the position assigned to each drawing.

Those pictures in which there was a complete agreement as to the place in the five point scale were selected as the pattern for that place. Two pictures were then pulled from each of the five places, mounted on a sheet and photostated. They thus became the scale for measuring the portrayal of activity as expressed in the arms. The same procedure was followed for the other three factors.

Thus, inasmuch as these were "knowledge" pictures, it may be said that insofar as this scale measured the number of additional objects, the activity portrayed, the proportion of one part to another, and the awareness of one's environment, it measured: the association (or suggestibility), the concept of proportion, the activity concept, and the awareness of one's environment, which were a part of the child's knowledge. In other words, the scale measured by use of a mirror - the drawings - these concepts.

THE FINDINGS

Upon completing the construction of the scale it was used by five other graduate students in rating the pictures. Table 1 contains the coefficients obtained by comparing the scores on the various parts of the scale and also the coefficients obtained by comparing the combined score on the scale with the scores on the other tests and scales. The coefficient of .664 which these scores have with the scores on the Marston Scale is more clearly understood when the scales for the five factors are paralled with the statements on the Marston Scale.

TABLE 1

COEFFICIENTS OF CORRELATION

Element Compared with other factors	r	P.E.
Additional objects		
1. Activity expressed in the arms.	.366	-.065
2. Activity expressed in the legs.	.563	.061
3. Awareness of one's environment - activity	.484	.064
Activity expressed in the legs		
1. Activity expressed in the arms.	.735	.033
2. Awareness of one's environment - activity	.624	.043
3. Awareness of one's environment - dress.	.537	.050
4. Ratio of length width	.373	.062
Awareness of one's environment		
1. Activity compared with dress.	.659	.039
Combined score on activity expressed in arms and legs		
1. Time taken to draw the picture.	.521	.049
2. Scores on questions 3 and 13 of Marston Scale	.479	.052
Scores on the Scale		
1. Chronological age	.501	.050
2. I.Q. (Pintner-Cunningham)	.251	.063
3. I.Q. (Goodenough)	.244	.063
4. Rogers' Personality Adjustment.	-.059	.068
5. Thorndike Scale	.564	.046
6. Scores on the Marston Scale	.664	.037
Chronological age		
1. Thorndike Scale	.511	.050
2. Scores on the Marston Scale	.021	.068

This coefficient is all the more significant when compared with the coefficient .021 which the scores on the Marston Scale have with the chronological age. It would therefore appear that there is a definite relationship between the overt expression of the personality traits (quickness to respond to a situation, participation in activities, association with others and an awareness of one's environment) which are measured by the Marston Scale and those same traits as measured by the scale. This means that there is a definite relationship between the concept of a personality trait and the overt expression of that same trait.

VALIDATING THE FINDINGS

Inasmuch as the drawings were measured by the scale which had been constructed by the use of these same drawings the results thus obtained were checked by investigating a new group of children. The only alterations in the procedure were:

1. Every child held his paper thirteen minutes, but the time used in drawing the person was recorded on the sheet.
2. Four additional pictures were called for: a person and something else, an Indian, policeman and cowboy.

TABLE 2

THE SCORES ON THE SCALE COMPARED WITH THE SCORES ON THE OTHER TESTS AND SCALES

Scales	r	P.E.
1. Chronological age.	.486	-.066
2. I.Q. (Pintner-Cunningham).	.440	.066
3. I.Q. (Goodenough).	.542	.065
4. Thorndike Scale.	.643	.065
5. Scores on the Marston Scale.	.769	.063

Table 2 presents the coefficients which show the relationships existing between the scores on the scale and the scores on the other scales and tests.

THE SIGNIFICANT ASPECTS OF THE STUDY

Perhaps the most significant element in the study is the attempt to investigate the development of concepts in their relation to the personality traits of the child. It has often been said that the blacksmith sees the world through a horseshoe and the cobbler through the sole of a boot but just what relationship existed between the concept formation and the overt behavior of the child had not been definitely studied.

It was noted that the child who portrayed activity in respect to the "man" and the "person" also portrayed activity in respect to the "cowboy", the "Indian" and the "policeman" as well as animals such as dogs, horses and chickens. Thus it is seen that the general activity pattern was so well established as to act as a controlling factor in the building of new concepts. Using a different figure of speech, it would seem that it acted as a guide light so that the child saw the world, in general, as an active world.

The fact that there is a coefficient of correlation of .769 (-.063) between the portrayal of activity, the tendency to associate with others and an awareness of one's environment in the concepts and the overt expression of these same traits would lead one to ask: Is the concept the result of the overt behavior, is the overt behavior the expression of the concept or may they both be the result of something else?

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